

TRACKING INFORMATION TECHNOLOGY IN NORTHWEST PENNSYLVANIA

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for the

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EXECUTIVE SUMMARY

This study examines the level of activity in the Information Technology (IT) sector in the fourteen counties that comprise the three Workforce Investment Areas in Northwest Pennsylvania. The results are based on data from the Pennsylvania Department of Labor and Industry and the U.S. Bureau of Labor Statistics. Key findings are as follows.

- ▶ There are seventeen occupations identified in this report that can be considered IT professions. These include high-skill jobs in computer and selected engineering professions, along with the managers of workers in those fields, and postsecondary computer science instructors.
- ▶ Examination of a range of economic and demographic variables for the region paints the picture of a region that is growing, but at a slower rate than the state and the nation. Inflation-adjusted wages have actually fallen in the region over the last few decades, although real income has risen.
- ▶ There were about 4,900 IT jobs in the study region in 2000, according to these definitions, out of a total employment of over 450,000.
- ▶ The IT sector accounted for not quite 1.1% of all jobs in the northwest region, but nearly 2.5% of all jobs statewide. Clearly, the region had less than “its share” of IT activity in 2000 compared to the state.
- ▶ Wages in IT occupations tend to be significantly higher than in non-IT occupations.
- ▶ IT wages tend to be lower in the region than in Pennsylvania generally, and lower in the state than in the nation.
- ▶ Even after adjusting for differences in the cost of living across the state, IT jobs in the northwest Pennsylvania region pay less than the average for the state.
- ▶ Lower wages for IT professionals in northwest PA should be a competitive advantage for attracting firms that hire IT workers, other things equal.
- ▶ Conversely, lower real wage levels will tend to make the region less attractive to IT workers, unless there are some compensating differentials to offset the lower wages in the form of local amenities, opportunities for professional advancement, family ties, etc.
- ▶ The PA Department of Labor and Industry projects slow, but positive, employment growth in the region over the first decade of the new millennium. They expect much more rapid growth in IT jobs locally, with a total of over 6,000 IT jobs expected by 2010.
- ▶ Those projects include nearly a 20% growth rate for regional IT jobs during the decade. While this is a much higher growth rate than the northwest Pennsylvania region has been experiencing, it is below the 25.4% growth rate projected for the state’s IT sector. This implies that the region will continue to fall behind, relative to the state, unless something is done to change current patterns..
- ▶ Not all IT occupations are projected to grow; some are expected to maintain stable levels of employment and others are expected to decline.
- ▶ Just-released projections show slightly slower growth rates expected for the IT sector over the period from 2002-2012, but these rates are still significantly faster than the expectations for the overall economy. IT continues to be a growth sector.

I. THE NORTHWEST PENNSYLVANIA REGION

A) DEFINITION OF THE REGION

The geographic focus of this report is three Workforce Investment Areas (WIAs) in northwest Pennsylvania, specifically the Northwest, North Central and West Central WIAs. These include fourteen counties, as shown Figures 1 and 2 below.

In 2003 these fourteen counties were home to 965,000 people or 7.8% of the state's total population, 497,000 jobs (7.1% of state total employment), and nearly \$24 billion of income (6.0% of total state income.)

This section will provide a brief overview of selected indicators for the region, as background for the information technology data to come later.

Figure 1
The Northwest Pennsylvania Region

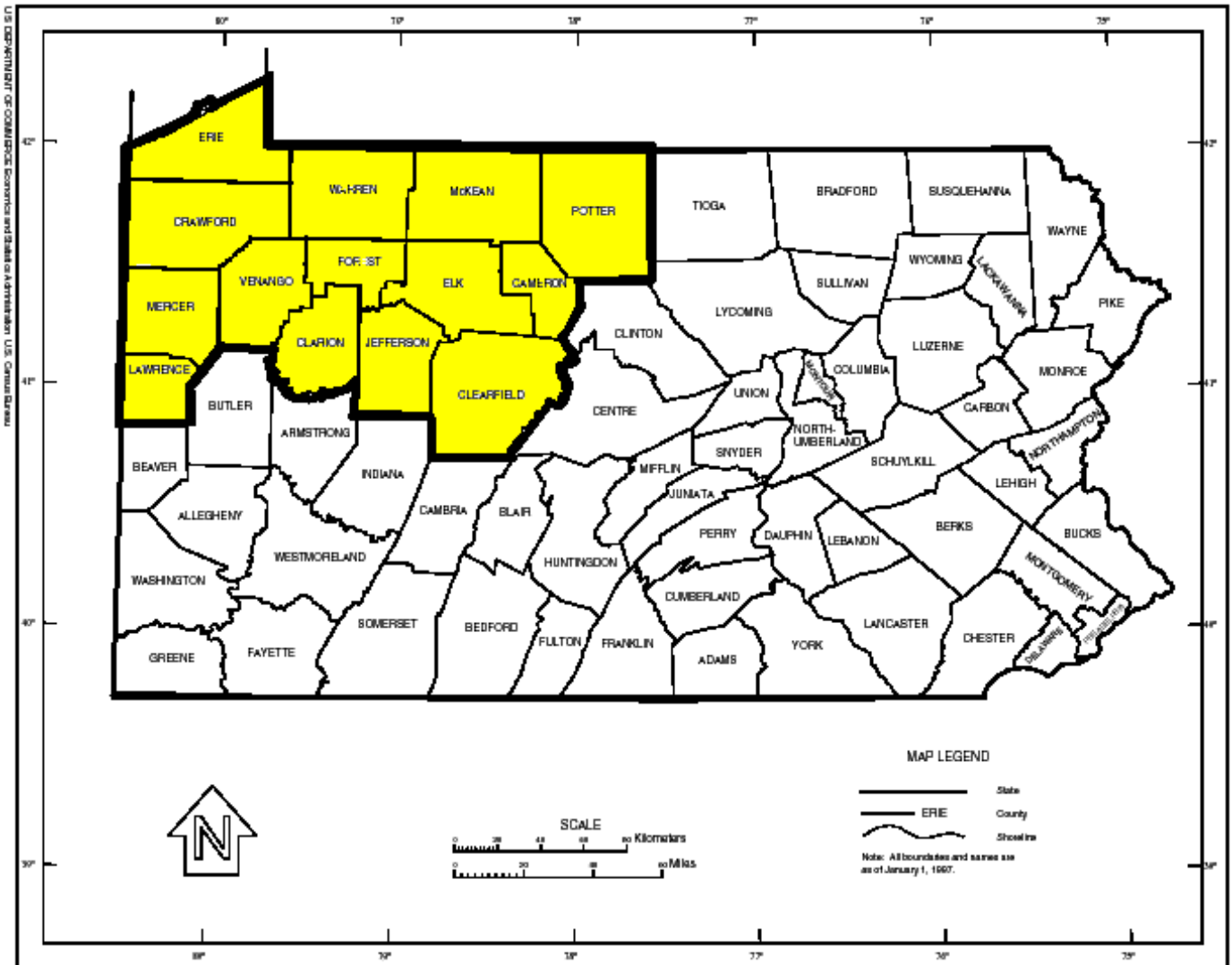
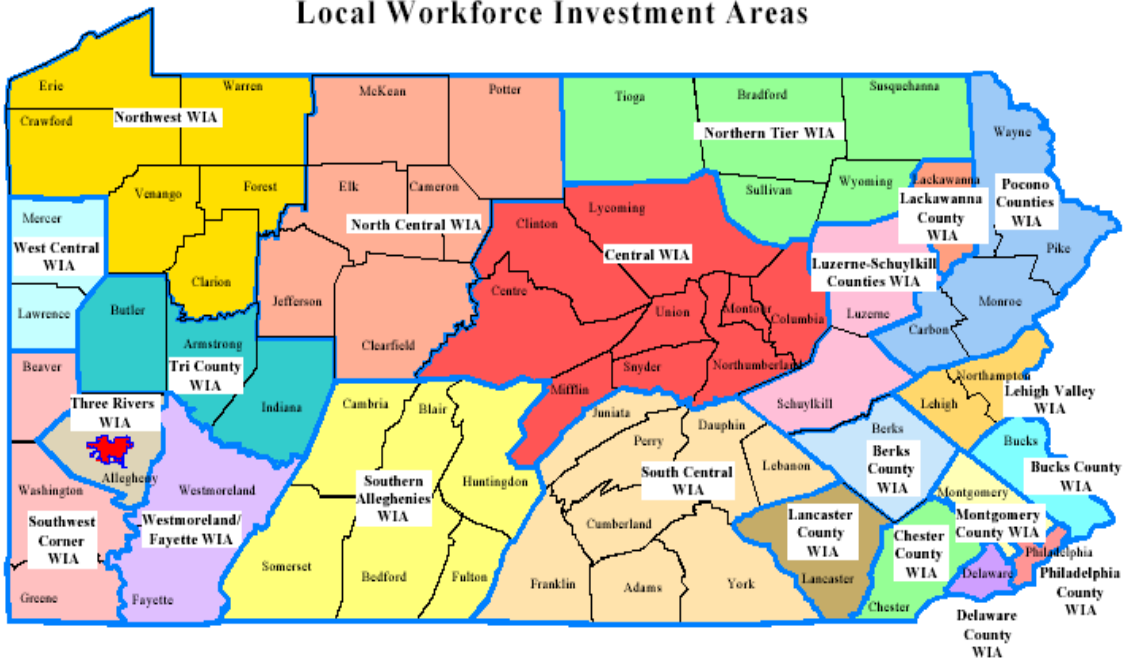


Figure 2
PENNSYLVANIA
Local Workforce Investment Areas

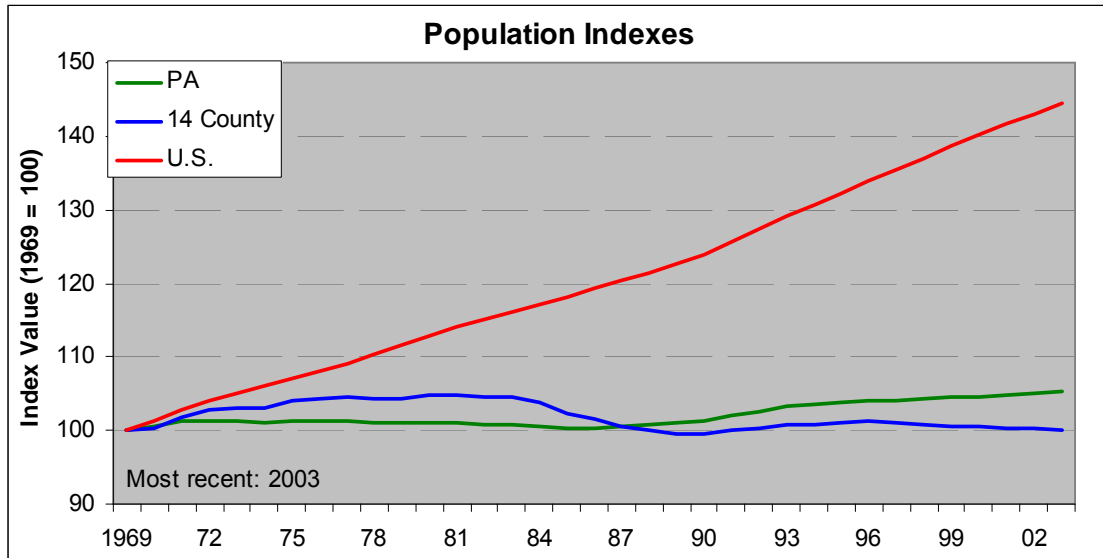


- | | | |
|---------------------------------|--------------------------|------------------------------|
| Berks County WIA | North Central WIA | South Central WIA |
| Berks | Cameron | Adams |
| Bucks County WIA | Clearfield | Cumberland |
| Bucks | Elk | Dauphin |
| Central WIA | Jefferson | Franklin |
| Centre | McKean | Juniata |
| Clinton | Potter | Lebanon |
| Columbia | Northern Tier WIA | Perry |
| Lycoming | Bradford | York |
| Mifflin | Sullivan | Southern Alleghenies WIA |
| Montour | Susquehanna | Bedford |
| Northumberland | Tioga | Blair |
| Snyder | Wyoming | Cambria |
| Union | Northwest WIA | Fulton |
| Chester County WIA | Clarion | Huntingdon |
| Chester | Crawford | Somerset |
| Delaware County WIA | Erie | Southwest Corner WIA |
| Delaware | Forest | Beaver |
| Lackawanna County WIA | Venango | Greene |
| Lackawanna | Warren | Washington |
| Lancaster County WIA | Philadelphia WIA | Three Rivers WIA |
| Lancaster | Philadelphia | Allegheny |
| Lehigh Valley WIA | Pocono Counties WIA | Tri-County WIA |
| Lehigh | Carbon | Armstrong |
| Northampton | Monroe | Butler |
| Luzerne-Schuylkill Counties WIA | Pike | Indiana |
| Luzerne | Wayne | West Central WIA |
| Schuylkill | | Lawrence |
| Montgomery County WIA | | Mercer |
| Montgomery | | Westmoreland and Fayette WIA |
| | | Fayette |
| | | Westmoreland |

B) DEMOGRAPHIC AND ECONOMIC DATA FOR THE REGION

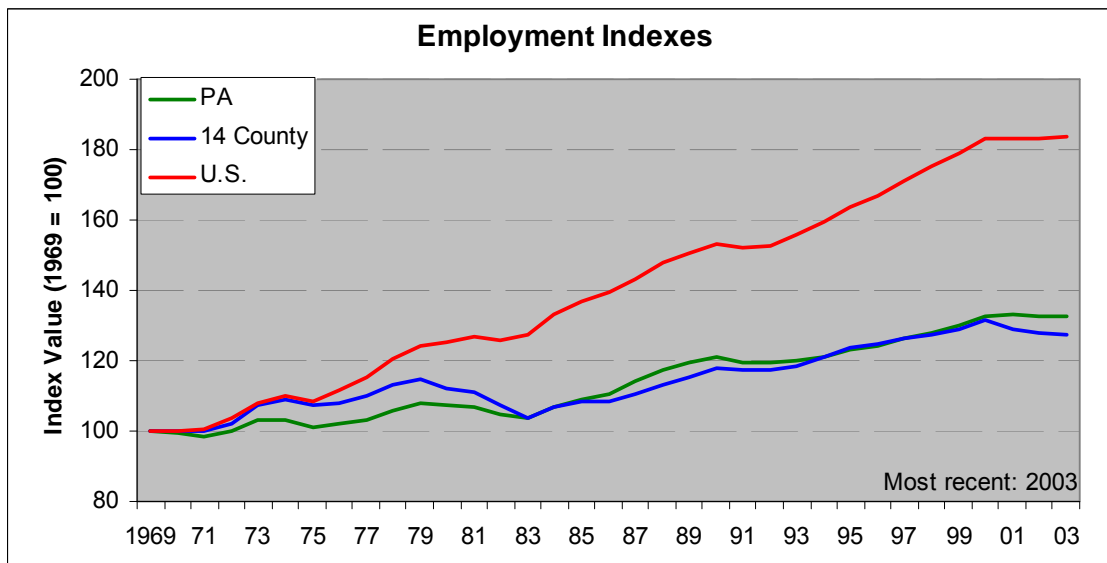
The following graphs tell the region's story in terms of population, employment and income since 1969, both in absolute terms and compared to the state and the nation.¹

Figure 3



Population in the region grew modestly, but faster than the State, from 1969 to 1984. Population in the region actually fell during the late 1980s and has been stagnant since, ending the period at roughly the same level at which it had started in 1969. Both the state and the region have not kept pace with national growth in population, which may be expected from an older, northeastern state. But the region has done worse than the state as a whole in the last two decades. Regional population growth has been sluggish, at best.

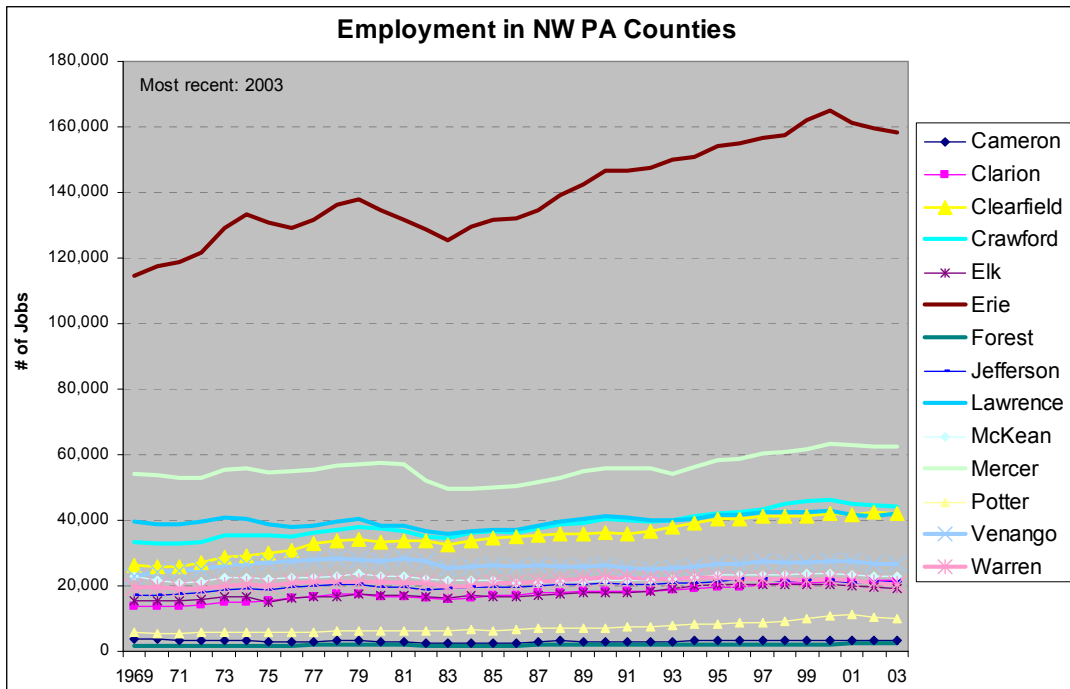
Figure 4



¹Most of these data series go back to 1969 because that is the earliest year available from the Bureau of Economic Analysis's Regional Economic Information System.

Employment in the region has tended to keep pace with the state, although not the nation. Employment grew about 27% from 1969 to 2003, growing to nearly 500,000 jobs. It can be noted from Figure 4 that the recessions of 1979-83 and 2000-2003 hit the region harder in employment terms than either the state or the nation. This is primarily a function of the region's industry and occupation mixes. In evaluating the most recent data, it is necessary to remember that they are most likely taken from a recession period, and may be lower than the typical values for that reason.

Figure 5



The employment graph for the fourteen counties of the region are shown in Figure 5 above. A few key conclusions can be drawn from it. First, there is quite a range of sizes among the counties of the region, from the largest (Erie) to the smallest (Forest). Second, employment growth is the typical experience over the 1969-2003 period. Figure 6 below shows this more clearly. There has been job growth in all of the fourteen counties except Cameron. In fact, six of the fourteen counties outpaced the state employment growth rate over the 1969-2003 period, but none beat the national rate. These facts imply that the region is accounting for an increasingly smaller share of state employment, as is verified in the next graph, Figure 7.

Figure 6

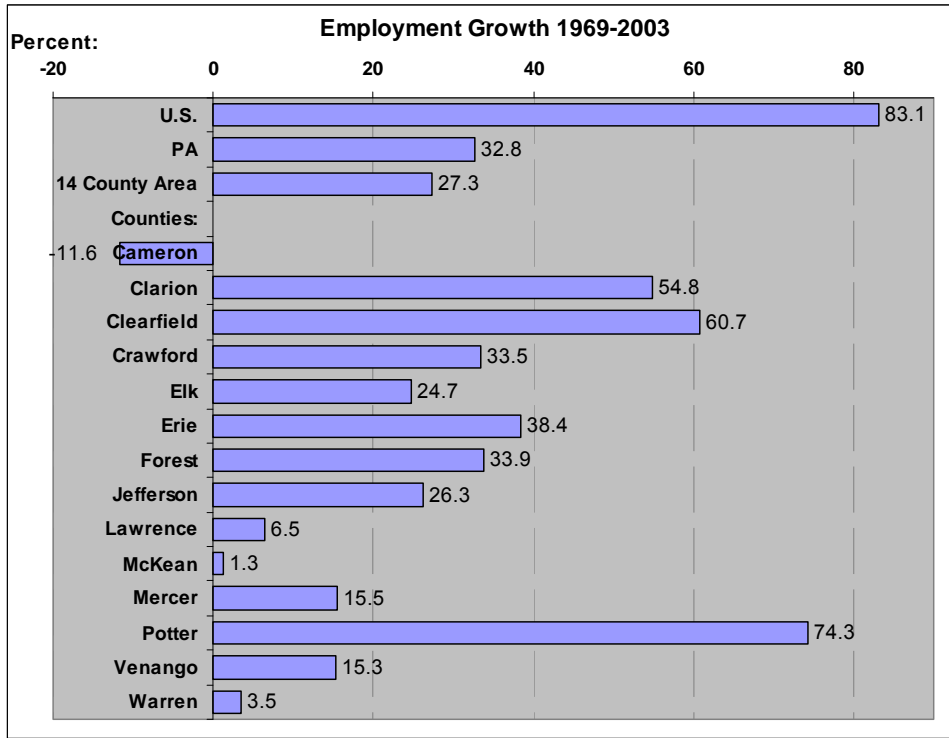
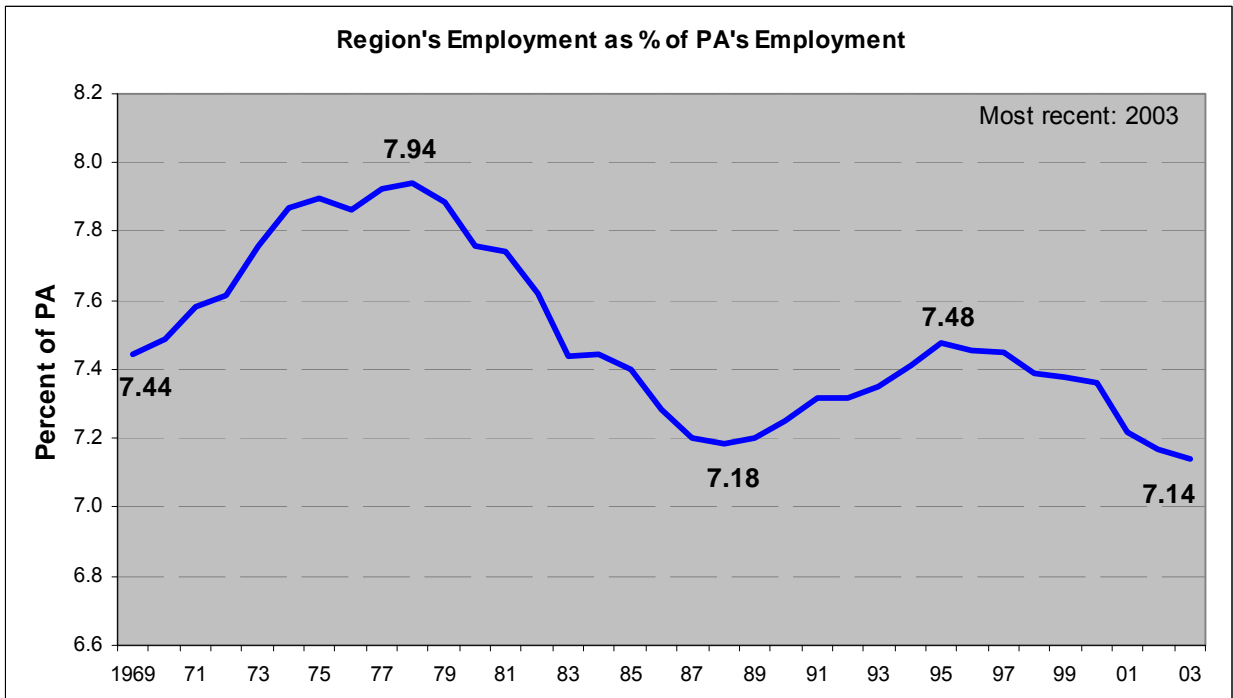
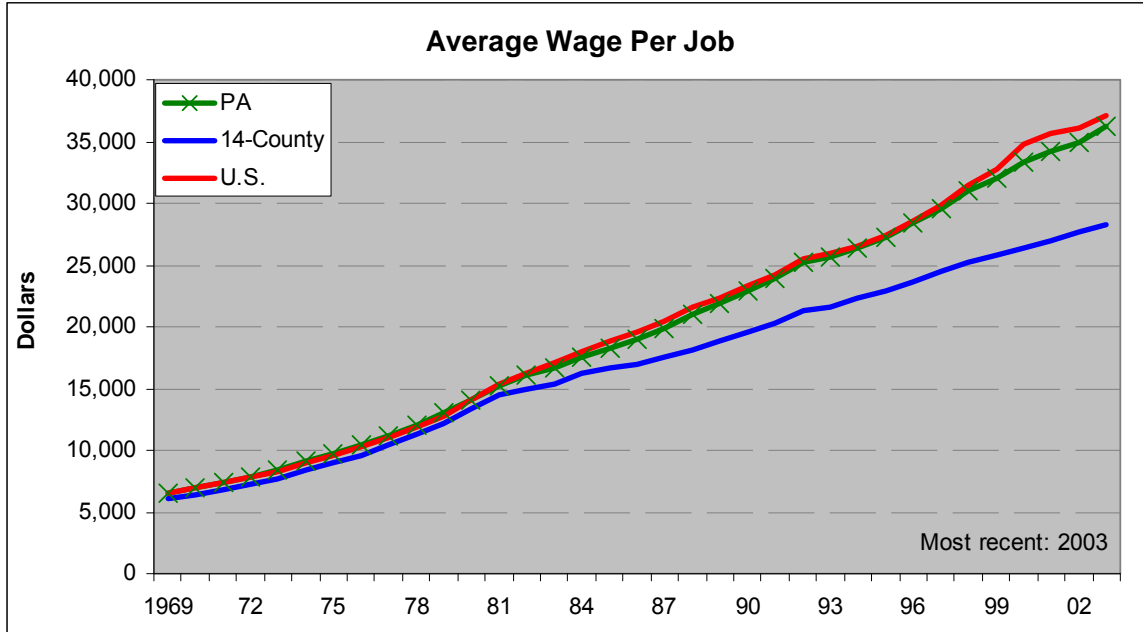


Figure 7



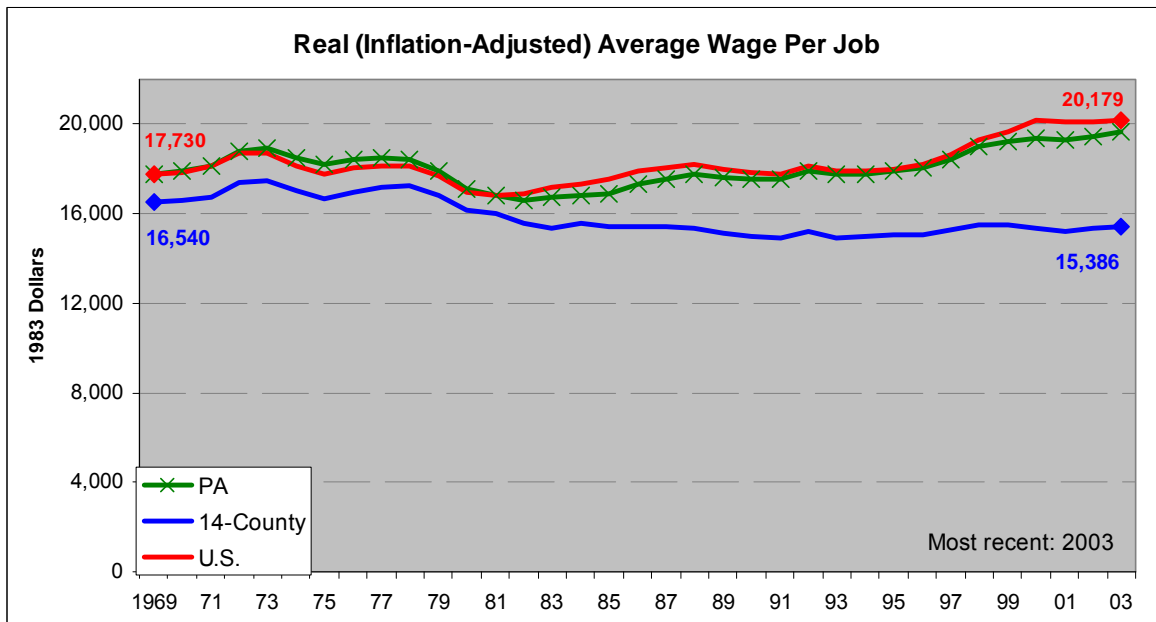
But what about the income arising from these jobs? Figure 8 shows that wages per job have increased consistently in the region, rising a total of 366% over the 1969-2003 period. But they have not kept pace with the average for the state (which rose 454%) and nation (471%)—a sluggish pattern similar to that of employment growth.

Figure 8



We see a different story once we adjust for inflation, however. During the 1969-2003 period, prices rose nationally by 401%, so real (inflation-adjusted) wages have actually fallen by 7% in the region since 1969. In Pennsylvania as a whole, real wages rose by 11%, and nationally by 14%. Figure 9 tells a disturbing story; real wages peaked in the region in 1973.

Figure 9



But wages are not the only component of income. Figure 10 shows that total (aggregate) income grew in all three areas under consideration, before adjustment for inflation, but again grew more slowly in both the region and the state than in the nation over this period.

Figure 10

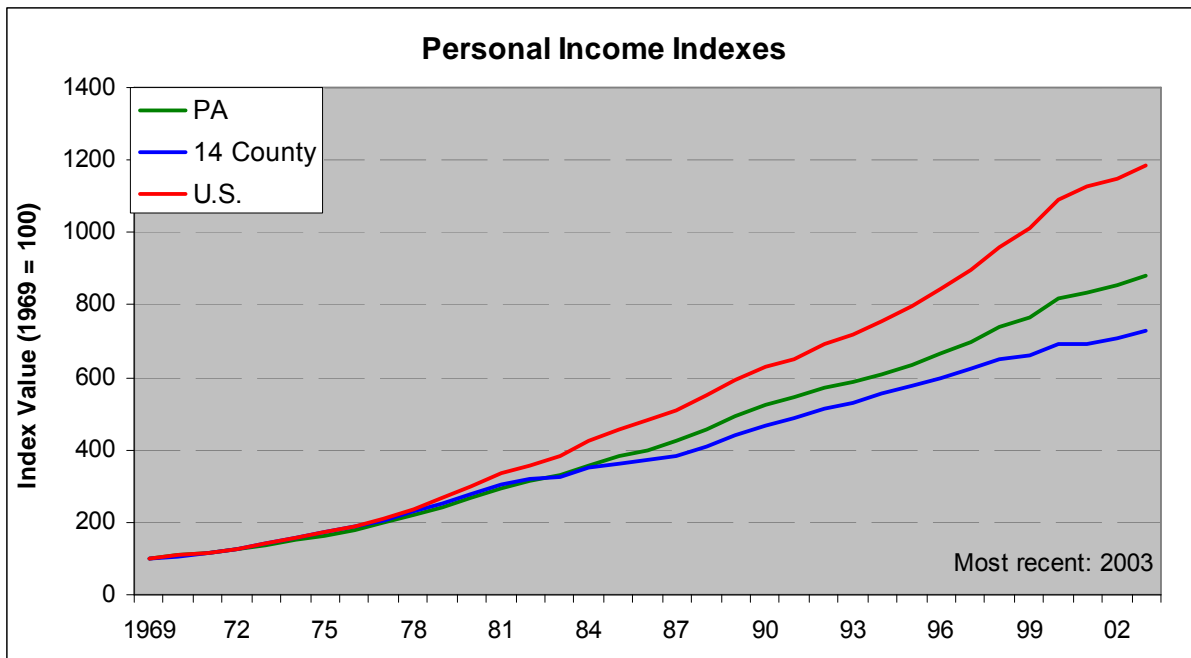
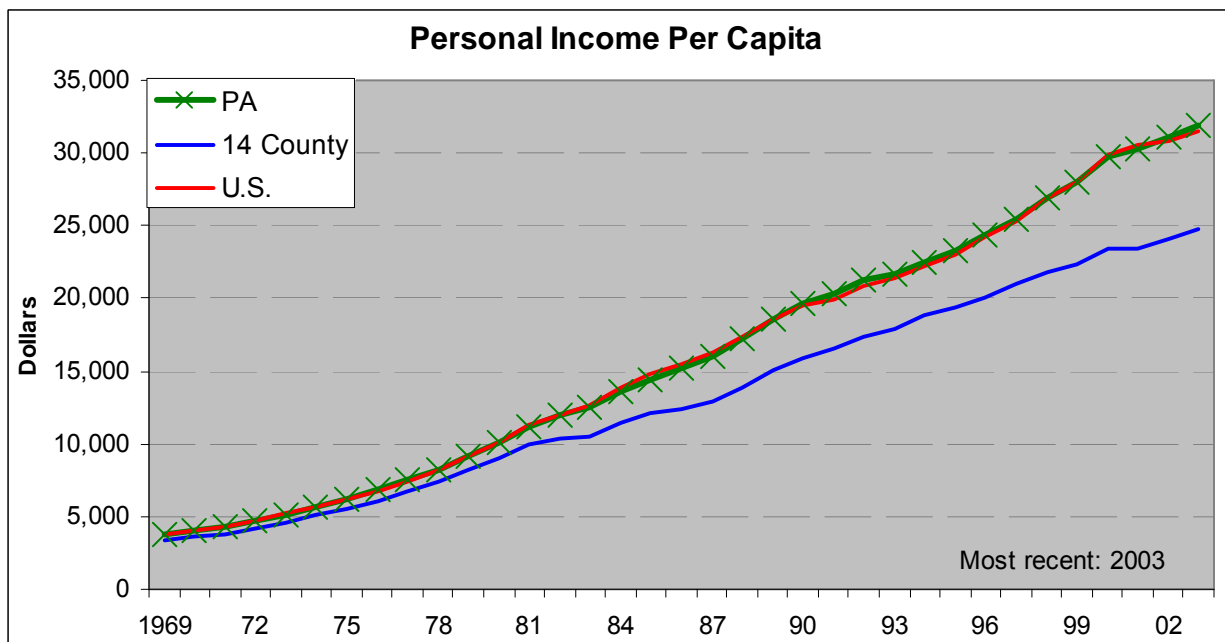


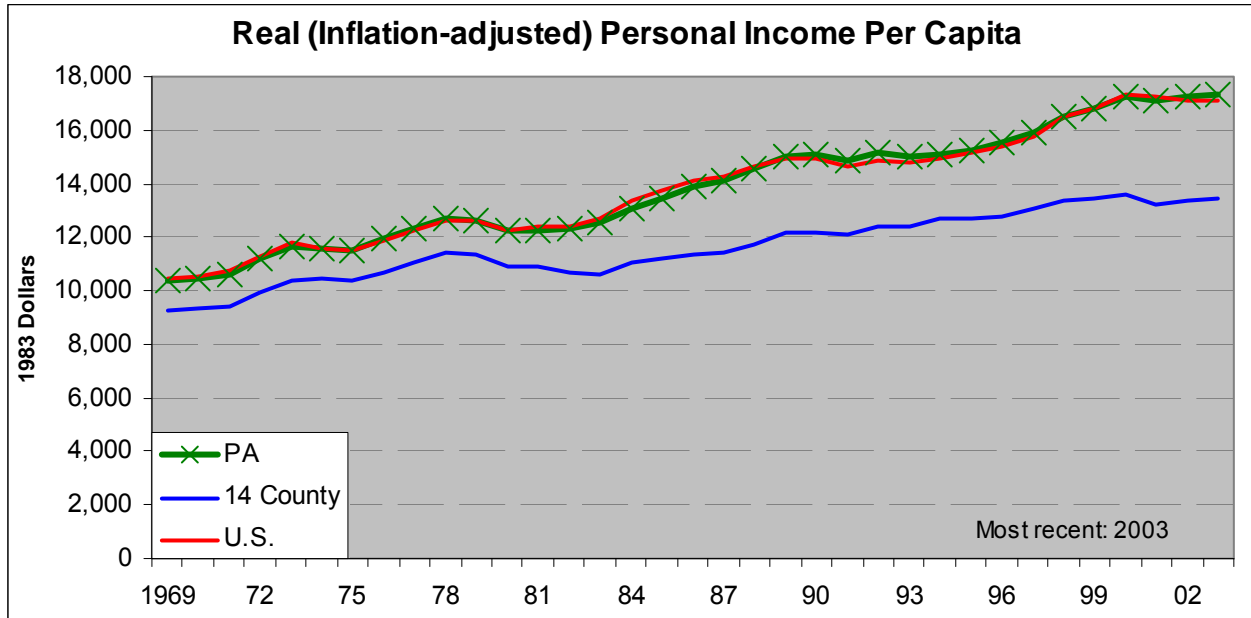
Figure 11



Switching from aggregate income to income per capita, we see in Figure 11 that income at the state level tracked the national level very closely. This pattern is different from the preceding graph in that it takes account of slow population growth in PA, resulting in higher income per capita. Once again the region lags both the nation and the state, although all three areas show consistent growth in income per capita

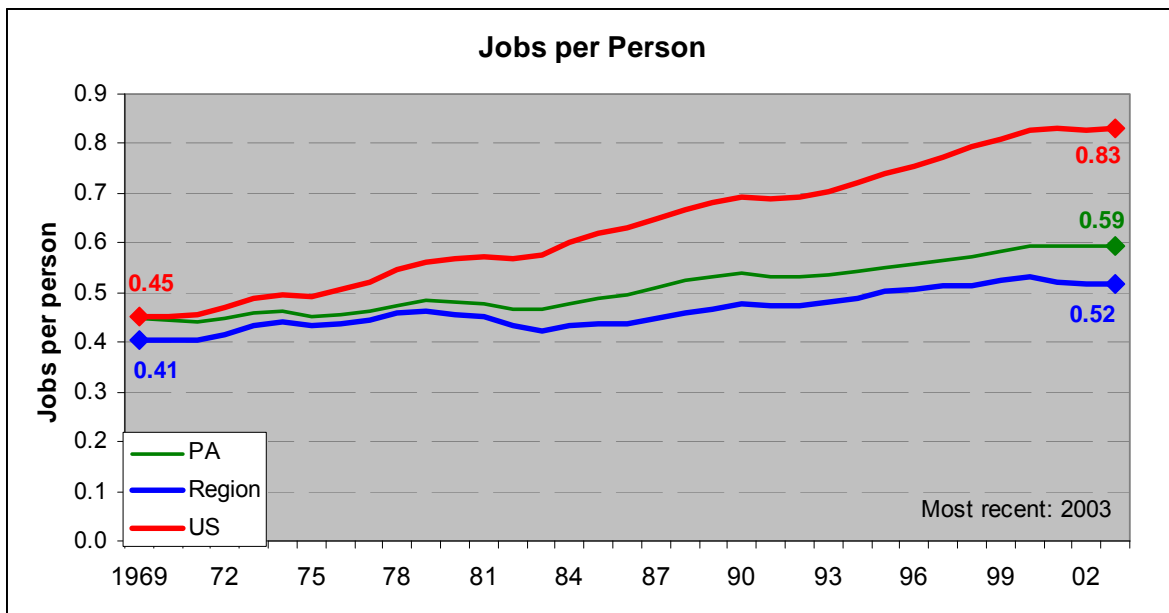
over the period, with slight downturns marking the recessions. But this graph does not take account of inflation over the period.

Figure 12



Adjusting the income data for inflation, we see that real income per capita grew by about 45% over the period in the region. While this is definitely good news, we note that again the region did not keep up with growth in the state (67%) or the nation (64%). The pattern of growth in income per capita is different from the story of decline told by wages per job, given above. This is due partially to an increase in the average number of jobs per person (with multiple job-holding and/or greater labor force participation by those who did not work before) as shown on Figure 13 below. It is also due to increases in the non-earnings components of income such as dividends, interest and rents, and government transfer payments. Earnings now account for less than 2/3 of income in the region, compared with nearly 80% in 1969.

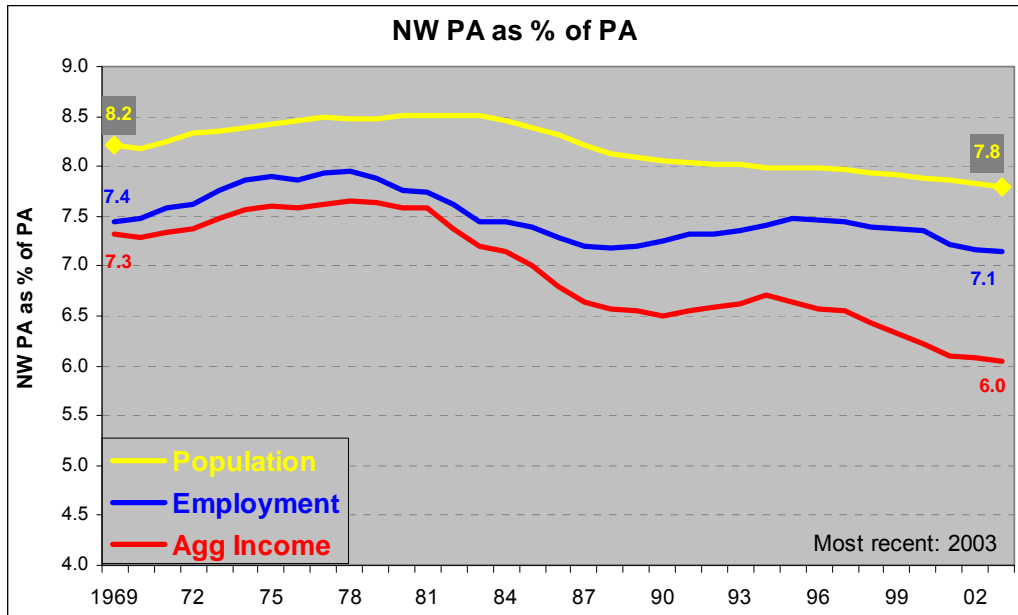
Figure 13



Summary

Overall, these data for the region tell a story of growth in income and employment in the region, and that's good news. But the bad news is that it is a story of very modest growth, typically at rates slower than the growth of the state or the nation. As a result, the region is becoming a smaller relative part of the state, as shown in Figure 14 below. We're just not keeping up. This is especially true for aggregate income. We note that a program that would raise income and employment levels in the community would help to turn these lines around. One key way to do this would be through education and training for the right occupations.

Figure 14



II. INFORMATION TECHNOLOGY OCCUPATIONS

The goal of this report is to examine information technology (IT) activity in the northwest Pennsylvania region. There are two obvious approaches to measuring IT activity: 1) by industry, and 2) by occupation. In this report, we have chosen to focus on the occupational approach, recognizing that all industries must deal with information to some extent, and thus must have some IT workers. A focus on *industries* that are IT-producing or predominantly IT-using would miss a significant number of IT workers, those who happen to work in the other industries. But a focus on IT *occupations* should catch them, regardless of the product or service that is ultimately produced by their firms.

Which occupations should be categorized as “official” IT occupations? For this we turn to a report issued by the Economics and Statistics Administration of the U.S. Department of Commerce: *Digital Economy 2003*. This is the fifth in a series of reports “...on the performance of American industries that produce information technology (IT) goods and services, and the effects of IT on U.S. economic strength.”²

Although their focus is on industries they also deal with the issue of IT occupations, identifying the occupations shown in Table n as IT-related occupations, and classifying them into three skill levels. For this report, we will focus on the high-skill occupations, those which require an associate degree or higher.³ These fall into three major Standard Occupational Code (SOC) categories: SOC 11: Management Occupations; SOC 15: Computer and Mathematical Occupations; and SOC 17: Architecture and Engineering Occupations.⁴ The core of these IT occupations are the computer occupations in SOC 15, but the second major group are the engineers in SOC 17 who deal with computers and related electronics. The third group consists of the managers of both these groups of workers, who fall into SOC 11.

We note that *Digital Economy 2003* excludes SOC 15-1090: Miscellaneous Computer Specialists, the catchall category for those who don't fall into the individual computer categories above. We think it wise to include this category, to ensure that none of the IT workers fall through the cracks.

It may also be beneficial to include one more category not identified by *Digital Economy 2003*: SOC 25-1021: Computer Science Teachers, Postsecondary. This category includes the professors and other post-high school teachers who train the IT workers in SOC 15. These educators are clearly involved in the IT industry, and aside from their teaching activities may engage in both IT-related research and IT-related consulting activities. We choose to exclude SOC 25-1032, Engineering Teachers, Postsecondary, since most in that category do not train for the IT-related fields; most engineers do not fall into the IT occupations listed above.

The High Skill portion of the list given in Table 1 will be the focus of this report. More detailed descriptions of these occupations are given in Appendix B.

²There was no “*Digital Economy 2004*”, although the Economics and Statistics Administration expects to release a 2005 version in the summer of this year.

³*Digital Economy 2003*'s definitions of skill levels are the following. High skill: associate degree or higher. Moderate skill: long-term on-the-job training (OJT), related work experience, or post-secondary vocational training. Low skill: short- to moderate-term OJT. *Digital Economy 2003*, p. 27.

⁴The Standard Occupational Code (SOC) classification system is explained in Appendix A.

Table 1
Information Technology Occupations

<u>SOC</u>	<u>Occupation</u>
Skill Level: High	
11-3020	Computer and information systems managers
11-9040	Engineering managers
15-1010	Computer and information scientists, research
15-1020	Computer programmers
15-1031	Computer software engineers, applications
15-1032	Computer software engineers, systems software
15-1040	Computer support specialists
15-1050	Computer systems analysts
15-1060	Database administrators
15-1070	Network and computer systems administrators
15-1080	Network systems and data communications analysts
15-1090*	Miscellaneous Computer Specialists
17-2060	Computer hardware engineers
17-2071	Electrical engineers
17-2072	Electronics engineers, except computer
17-3023	Electrical and electronic engineering technicians
25-1021*	Computer Science Teachers, Postsecondary
Skill Level: Moderate	
43-9021	Data entry keyers
49-2010	Computer, automated teller, and office machine repairers
49-2022	Telecommunications equipment installers and repairers, exc. line installers
49-2094	Electrical and electronics repairers, commercial and industrial equipment
49-9051	Electrical power-line installers and repairers
49-9052	Telecommunications line installers and repairers
51-2022	Electrical and electronic equipment assemblers
51-2023	Electromechanical equipment assemblers
51-9140	Semiconductor processors
Skill Level: Low	
43-2000	Communications equipment operators
43-3020	Billing and posting clerks and machine operators
43-9010	Computer operators
43-9070	Other office machine operators, exc. computer

Source: *Digital Economy 2003*, p. 26. Standard Occupational Codes (SOCs) codes added by the author.
*Occupations not listed in *Digital Economy 2003* but added for this report, as explained in the text.

III. REGIONAL INFORMATION TECHNOLOGY DATA

What is the level of activity in the fourteen-county northwest Pennsylvania region in the IT occupations identified above? The key aspects are number of jobs and their wages. Let us start first with the number of jobs.

A) IT EMPLOYMENT

1) Employment in Workforce Investment Areas

Employment for detailed occupations are not as available as we might like. But the Pennsylvania Department of Labor and Industry has some data that are useful for our purposes, as does the U.S. Bureau of Labor Statistics.

While the Pennsylvania Department of Labor and Industry (L&I) apparently do not publish occupational data on an annual basis, their Long-Term Occupational Employment Projections program provides data on detailed occupations for the State, Workforce Investment Areas (WIAs), and Metropolitan Statistical Areas (MSAs) every two years. (Unfortunately, there are no data at the county level except when an MSA is synonymous with a county.) The key goal of this program is to provide 10-year projections, but we can use the base-year employment numbers from this program for the purposes of this report. Appendix D presents information on how this program prepares its projections, and the sources of its data.

At the time of this report, the most recent data available from this program are for the 2000-2010 projections.⁵ The tables below present data for the IT occupations which are the focus of this report. In all these tables, the column "Sum of WIAs" gives totals for the fourteen-county, three-WIA northwest Pennsylvania region.

Table 2 below shows that there were an estimated 4,920 IT jobs in northwest PA in 2000, with 2,700 (55%) of those in the Northwest WIA, 1,370 (28%) in the North Central WIA, and the remaining 850 (17%) in the West Central WIA. Figure 15 shows that the largest category, with nearly 1,000 jobs locally, is Computer Support Specialists, followed by Computer Programmers (560) and Engineering Managers (480).

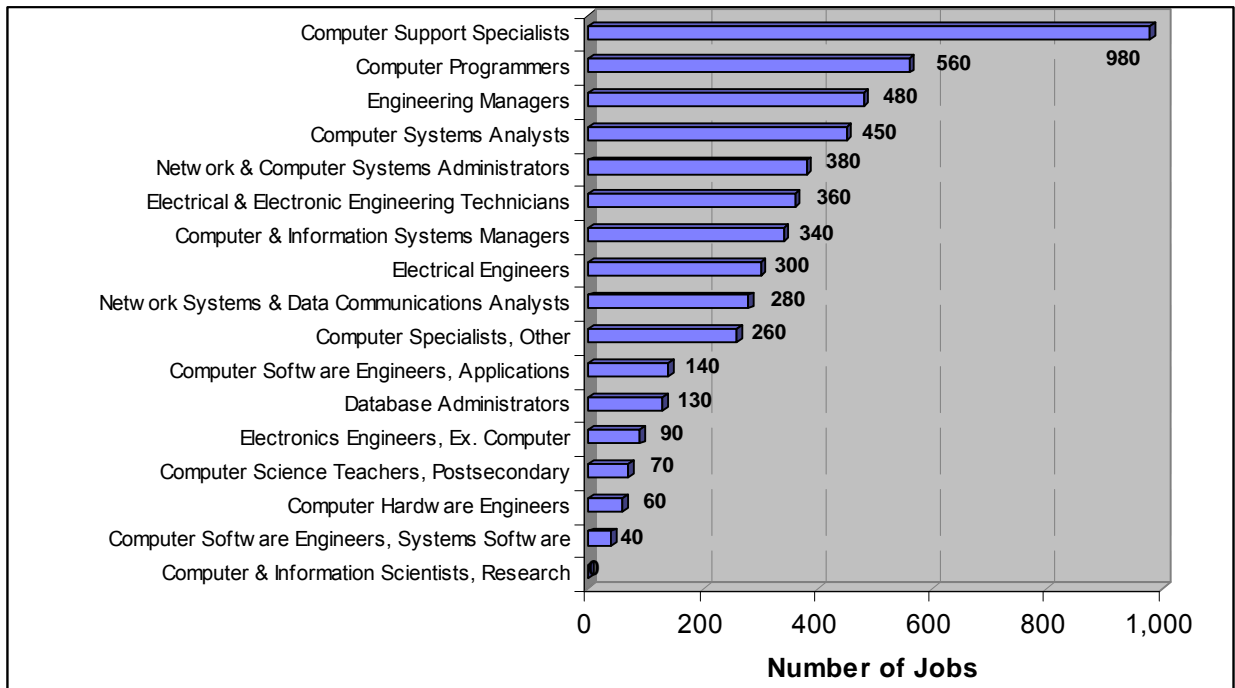
⁵ A new set of projections will be released in the summer of 2005 which will cover the period from 2002 to 2012, and thus give baseline data for the year 2002. WIA data are expected to be available in July. But the Department of Labor and Industry graciously made the state and MSA-level data from this program available to the author before the data were officially released. We thank them for this. These data are presented later in this report.

Table 2
Estimated 2000 Employment

Estimated 2000 Employment

SOC Code	Occupational Title	Estimated Employment 2000				
		PA	Sum of WIAs	NW	NC	WC
00-0000	Total, All Occupations	6,125,800	450,610	249,970	105,980	94,660
11-3021	Computer & Information Systems Managers	14,000	340	110	160	70
11-9041	Engineering Managers	9,200	480	270	150	60
15-1011	Computer & Information Scientists, Research	400	0	0	0	0
15-1021	Computer Programmers	21,750	560	370	100	90
15-1031	Computer Software Engineers, Applications	10,150	140	100	10	30
15-1032	Computer Software Engineers, Systems Software	7,950	40	10	10	20
15-1041	Computer Support Specialists	18,350	980	420	340	220
15-1051	Computer Systems Analysts	19,700	450	230	80	140
15-1061	Database Administrators	4,250	130	80	40	10
15-1071	Network & Computer Systems Administrators	9,750	380	240	90	50
15-1081	Network Systems & Data Communications Analysts	4,900	280	160	100	20
15-1099	Computer Specialists, Other	7,650	260	130	70	60
17-2061	Computer Hardware Engineers	1,100	60	50	10	0
17-2071	Electrical Engineers	7,400	300	220	50	30
17-2072	Electronics Engineers, Ex. Computer	2,800	90	40	50	0
17-3023	Electrical & Electronic Engineering Technicians	10,450	360	200	110	50
25-1021	Computer Science Teachers, Postsecondary	1,800	70	70	0	0
	Total, IT occupations	151,600	4,920	2,700	1,370	850

Figure 15
2000 IT Employment in the 14-County Northwest PA Region



As shown in Table 3 below, the IT sector accounted for not quite 1.1% of all jobs in the northwest region, but nearly 2.5% of all jobs statewide. Clearly, the region had less than “its share” of IT activity in 2000 compared to the state.

Table 3
IT as a Percent of Total Employment

PERCENT OF TOTAL EMPLOYMENT

SOC Code	Occupational Title	Percent of Area's Total Employment 2000				
		PA	Sum of WIAs	NW	NC	WC
00-0000	Total, All Occupations	100.00	100.00	100.00	100.00	100.00
11-3021	Computer & Information Systems Managers	0.23	0.08	0.044	0.151	0.074
11-9041	Engineering Managers	0.15	0.11	0.108	0.142	0.063
15-1011	Computer & Information Scientists, Research	0.01	0.00	0.000	0.000	0.000
15-1021	Computer Programmers	0.36	0.12	0.148	0.094	0.095
15-1031	Computer Software Engineers, Applications	0.17	0.03	0.040	0.009	0.032
15-1032	Computer Software Engineers, Systems Software	0.13	0.01	0.004	0.009	0.021
15-1041	Computer Support Specialists	0.30	0.22	0.168	0.321	0.232
15-1051	Computer Systems Analysts	0.32	0.10	0.092	0.075	0.148
15-1061	Database Administrators	0.07	0.03	0.032	0.038	0.011
15-1071	Network & Computer Systems Administrators	0.16	0.08	0.096	0.085	0.053
15-1081	Network Systems & Data Communications Analysts	0.08	0.06	0.064	0.094	0.021
15-1099	Computer Specialists, Other	0.12	0.06	0.052	0.066	0.063
17-2061	Computer Hardware Engineers	0.02	0.01	0.020	0.009	0.000
17-2071	Electrical Engineers	0.12	0.07	0.088	0.047	0.032
17-2072	Electronics Engineers, Ex. Computer	0.05	0.02	0.016	0.047	0.000
17-3023	Electrical & Electronic Engineering Technicians	0.17	0.08	0.080	0.104	0.053
25-1021	Computer Science Teachers, Postsecondary	0.03	0.02	0.03	0.00	0.00
	Total, IT occupations	2.47	1.09	1.080	1.293	0.898

Comparisons of the region’s share of jobs with that of the state is made more convenient by use of location quotients (LQs). A location quotient is simply the region’s percent of jobs in an occupation compared to the state’s percent. For example, the region had 0.08% of its employment in Computer and Information System Managers (SOC 11-3021) in 2000, whereas statewide that occupation accounted for 0.23% of all jobs. The region’s location quotient is $0.08\% / 0.23\% = 0.33$ for this occupation. The region’s share of employment in this category is only about 1/3 of the state’s share. When the region has a larger percent of its jobs in an occupation than the state, the LQ will be greater than one, so LQs greater than one represent NW PA’s specialties. LQs that are less than one signify occupations in which we have less than the typical share of jobs compared to statewide standards.

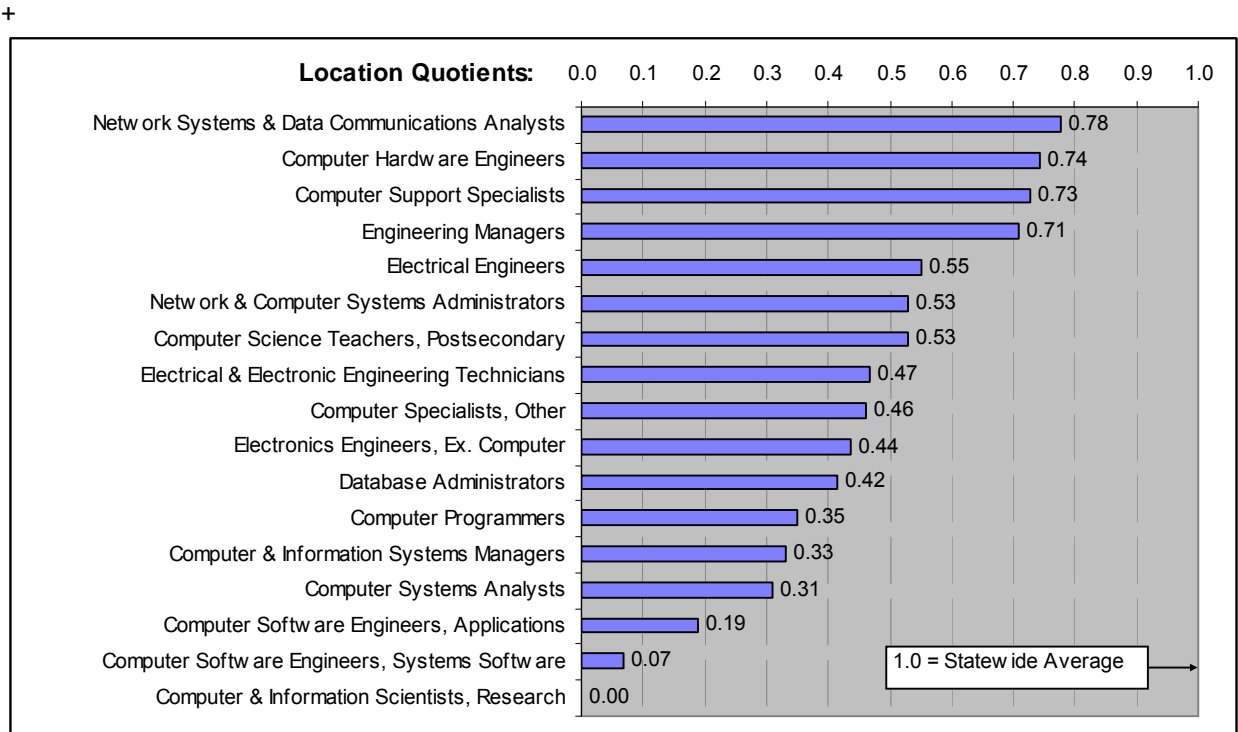
The accompanying graph, Figure 16, shows that the region has *no* LQs greater than one, indicating that we have no IT occupations with a greater than average employment level compared to the state. A review of the LQs for individual WIAs shows a few LQs greater than one: Computer Hardware Engineers in the Northwest WIA, and Network Systems and Data Communications Analysts, Computer Support Specialists, and non-computer Electronics Engineers in the North Central WIA. All the rest, including *all* categories for the West Central WIA, are less than 1.00. Northwest PA is clearly off the pace when it comes to IT jobs, and in some categories more so than others.

Table 4
Location Quotients
(WIA's % in an occupation / PA's % in that occupation)

LOCATION QUOTIENTS (A WIA's % in an occupation / PA's % in that occupation)

SOC Code	Occupational Title	2000 Location Quotients, compared to PA				
		PA	Sum of WIAs	NW	NC	WC
00-0000	Total, All Occupations	1.00	1.00	1.00	1.00	1.00
11-3021	Computer & Information Systems Managers	1.00	0.33	0.19	0.66	0.32
11-9041	Engineering Managers	1.00	0.71	0.72	0.94	0.42
15-1011	Computer & Information Scientists, Research	1.00	0.00	0.00	0.00	0.00
15-1021	Computer Programmers	1.00	0.35	0.42	0.27	0.27
15-1031	Computer Software Engineers, Applications	1.00	0.19	0.24	0.06	0.19
15-1032	Computer Software Engineers, Systems Software	1.00	0.07	0.03	0.07	0.16
15-1041	Computer Support Specialists	1.00	0.73	0.56	1.07	0.78
15-1051	Computer Systems Analysts	1.00	0.31	0.29	0.23	0.46
15-1061	Database Administrators	1.00	0.42	0.46	0.54	0.15
15-1071	Network & Computer Systems Administrators	1.00	0.53	0.60	0.53	0.33
15-1081	Network Systems & Data Communications Analysts	1.00	0.78	0.80	1.18	0.26
15-1099	Computer Specialists, Other	1.00	0.46	0.42	0.53	0.51
17-2061	Computer Hardware Engineers	1.00	0.74	1.11	0.53	0.00
17-2071	Electrical Engineers	1.00	0.55	0.73	0.39	0.26
17-2072	Electronics Engineers, Ex. Computer	1.00	0.44	0.35	1.03	0.00
17-3023	Electrical & Electronic Engineering Technicians	1.00	0.47	0.47	0.61	0.31
25-1021	Computer Science Teachers, Postsecondary	1.00	0.53	0.95	0.00	0.00
	Total, IT occupations	1.00	0.44	0.44	0.52	0.36

Figure 16
Location Quotients for the 14-County Northwest PA Region



a. Within the IT Sector

While the previous section explored the region’s IT sector as a portion of its total employment, this section focuses specifically on the makeup of the region’s IT sector alone. The following two tables compare the distribution of Northwest PA’s IT jobs with the state distribution. It is clear that our IT sector is a little different from the statewide average, with greater concentrations in Network Systems and Data Communications Analysts (5.7% locally vs. 3.2% statewide), Computer Support Specialists (19.9% vs. 12.1%), Computer Hardware Engineers (1.2% vs. 0.7%) and Engineering Managers (9.9% vs. 8.1%), to name the major differences. Table 6 presents location quotients (LQs), which make it easier to identify the sectors with greater differences from the statewide average pattern. LQs that are very high represent Northwest PA’s specialties; those that are very low signify occupations in which we have much less than the typical share of jobs. The latter include Computer Software Engineers, and Computer and Information Systems Managers.

**Table 5
Distribution of IT Jobs**

DISTRIBUTION OF IT JOBS

SOC Code	Occupational Title	Distribution of Computer Specialist Jobs (Percent)				
		PA	Sum of WIAs	NW	NC	WC
00-0000	Total, All Occupations					
11-3021	Computer & Information Systems Managers	9.2	6.9	4.1	11.7	8.2
11-9041	Engineering Managers	6.1	9.8	10.0	10.9	7.1
15-1011	Computer & Information Scientists, Research	0.3	0.0	0.0	0.0	0.0
15-1021	Computer Programmers	14.3	11.4	13.7	7.3	10.6
15-1031	Computer Software Engineers, Applications	6.7	2.8	3.7	0.7	3.5
15-1032	Computer Software Engineers, Systems Software	5.2	0.8	0.4	0.7	2.4
15-1041	Computer Support Specialists	12.1	19.9	15.6	24.8	25.9
15-1051	Computer Systems Analysts	13.0	9.1	8.5	5.8	16.5
15-1061	Database Administrators	2.8	2.6	3.0	2.9	1.2
15-1071	Network & Computer Systems Administrators	6.4	7.7	8.9	6.6	5.9
15-1081	Network Systems & Data Communications Analysts	3.2	5.7	5.9	7.3	2.4
15-1099	Computer Specialists, Other	5.0	5.3	4.8	5.1	7.1
17-2061	Computer Hardware Engineers	0.7	1.2	1.9	0.7	0.0
17-2071	Electrical Engineers	4.9	6.1	8.1	3.6	3.5
17-2072	Electronics Engineers, Ex. Computer	1.8	1.8	1.5	3.6	0.0
17-3023	Electrical & Electronic Engineering Technicians	6.9	7.3	7.4	8.0	5.9
25-1021	Computer Science Teachers, Postsecondary	1.2	1.4	2.6	0.0	0.0
	Total, IT occupations	100.0	100.0	100.0	100.0	100.0

**Table 6
IT Location Quotients**

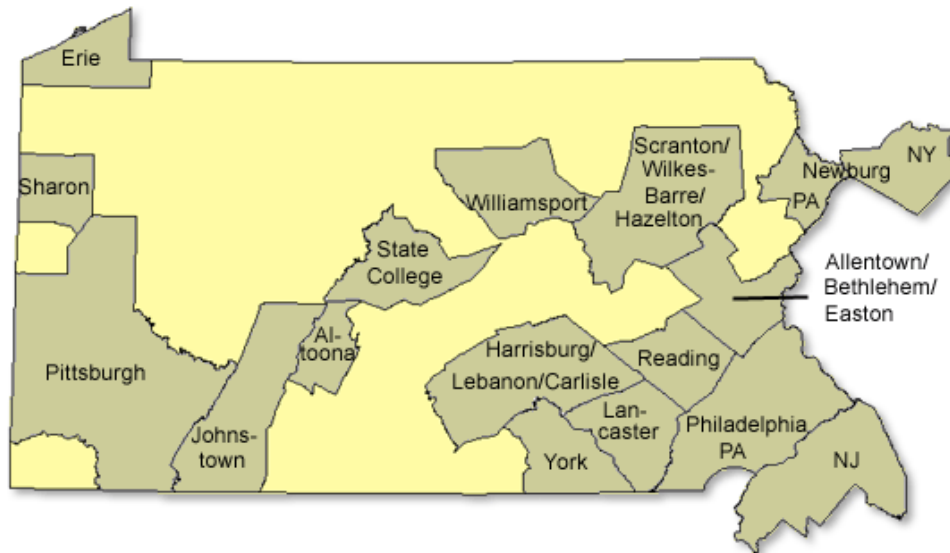
IT LOCATION QUOTIENTS

SOC Code	Occupational Title	2000 Location Quotients, compared to PA				
		PA	Sum of WIAs	NW	NC	WC
00-0000	Total, All Occupations					
11-3021	Computer & Information Systems Managers	1.00	0.75	0.44	1.26	0.89
11-9041	Engineering Managers	1.00	1.61	1.65	1.80	1.16
15-1011	Computer & Information Scientists, Research	1.00	0.00	0.00	0.00	0.00
15-1021	Computer Programmers	1.00	0.79	0.96	0.51	0.74
15-1031	Computer Software Engineers, Applications	1.00	0.43	0.55	0.11	0.53
15-1032	Computer Software Engineers, Systems Software	1.00	0.16	0.07	0.14	0.45
15-1041	Computer Support Specialists	1.00	1.65	1.29	2.05	2.14
15-1051	Computer Systems Analysts	1.00	0.70	0.66	0.45	1.27
15-1061	Database Administrators	1.00	0.94	1.06	1.04	0.42
15-1071	Network & Computer Systems Administrators	1.00	1.20	1.38	1.02	0.91
15-1081	Network Systems & Data Communications Analysts	1.00	1.76	1.83	2.26	0.73
15-1099	Computer Specialists, Other	1.00	1.05	0.95	1.01	1.40
17-2061	Computer Hardware Engineers	1.00	1.68	2.55	1.01	0.00
17-2071	Electrical Engineers	1.00	1.25	1.67	0.75	0.72
17-2072	Electronics Engineers, Ex. Computer	1.00	0.99	0.80	1.98	0.00
17-3023	Electrical & Electronic Engineering Technicians	1.00	1.06	1.07	1.16	0.85
25-1021	Computer Science Teachers, Postsecondary	1.00	1.20	2.18	0.00	0.00
	Total, IT occupations	1.00	1.00	1.00	1.00	1.00

2) Employment in Metropolitan Statistical Areas: Erie and Sharon

We'd like to have data for each of the fourteen counties of the focus region, but employment data by occupation are not available at the county level. However, there are data for Metropolitan Statistical Areas (MSAs). There are two officially-designated MSAs in the study area: Erie and Sharon. Each is a single-county MSA, comprised of Erie and Mercer Counties.⁶

Figure 17
Pennsylvania MSAs



Erie and Mercer counties accounted for just under half of the region's economic activity in 2003: 44.4% of regional employment, 43.0% of total income, and 41.8% of population. Thus while the two MSAs only include two of the region's fourteen counties, they are much more than just two among fourteen equals.

a. Pennsylvania Department of Labor and Industry Data

As previously mentioned, the Pennsylvania Department of Labor and Industry graciously made data from their 2002-2012 forecasts for PA MSAs available to the author before they were posted to the Department's website. Table 7 below provides employment estimates for 2002 for Erie and Mercer counties (listed as "Sharon" in the tables), along with the state of Pennsylvania for comparison. This more geographically detailed data set—at least for two counties—confirms the patterns found above for WIAs in 2000. Each county has quite a bit less of its employment in IT occupations than does the state as a whole: 1.3% in Erie and 0.9% in Mercer, compared to 2.4% for the state.

Moreover, this is true in almost all individual IT occupations, as shown by the LQs less than one in nearly all cases for the two areas and seventeen IT occupations. There are two exceptions to this general pattern. Erie County had 0.18% of its employment in the "Network & Computer Systems Administrators" category, virtually the same as the state. But it is in the "Computer Science Teachers, Postsecondary" category that Erie excelled, with 0.063% of its jobs compared to 0.039% at the state level, for an LQ of 1.62. This is clearly good news for Erie County, since the teachers and professors in this category train other IT professionals. The fact that Erie has more than its share of them implies that the region can

⁶ Sharon PA (Mercer County) was formerly a separate MSA, but in 2003 it became part of the redefined Youngstown-Warren-Boardman OH-PA MSA. The PA Department of Labor and Industry continues to publish data for the Sharon MSA (Mercer County), though. This map shows the 1990 definitions of the PA MSAs, several of which have changed in the interim. See <http://www.census.gov/population/www/estimates/metrodef.html> for details of MSA definitions.

generate more IT professionals to help fill the other IT occupational categories where the region has lower numbers than might be desired. Of course, just because a person gets his or her training here does not necessarily mean that he or she will stay in the local area after graduation. That appears to be a key part of the problem for the local IT sector. But high levels of activity in the “Comp Sci Teachers” category clearly presents an opportunity for the region.

**Table 7
Estimated 2002 Employment**

SOC Code	Occupational Title	Estimated Employment, 2002			Percent of Total Employment			Location Quotients	
		Pennsylvania	Erie	Sharon	Pennsylvania	Erie	Sharon	Erie	Sharon
Total, All Occupations		6,088,520	141,800	54,890	100.00	100.00	100.00		
11-3021	Computer & Information Systems Managers	13,130	180	40	0.22	0.13	0.07	0.59	0.34
11-9041	Engineering Managers	7,790	120	50	0.13	0.08	0.09	0.66	0.71
15-1011	Computer & Information Scientists, Research	540			0.01	0.00	0.00	0.00	0.00
15-1021	Computer Programmers	21,700	220	70	0.36	0.16	0.13	0.44	0.36
15-1031	Computer Software Engineers, Applications	10,010	80	30	0.16	0.06	0.05	0.34	0.33
15-1032	Computer Software Engineers, Systems Software	7,500	10	10	0.12	0.01	0.02	0.06	0.15
15-1041	Computer Support Specialists	20,450	320	140	0.34	0.23	0.26	0.67	0.76
15-1051	Computer Systems Analysts	18,650	140	30	0.31	0.10	0.05	0.32	0.18
15-1061	Database Administrators	4,280	80	10	0.07	0.06	0.02	0.80	0.26
15-1071	Network & Computer Systems Administrators	10,660	250	30	0.18	0.18	0.05	1.01	0.31
15-1081	Network Systems & Data Communications Analysts	6,140	90	10	0.10	0.06	0.02	0.63	0.18
15-1099	Computer Specialists, Other	6,460	130	20	0.11	0.09	0.04	0.86	0.34
17-2061	Computer Hardware Engineers	1,530			0.03	0.00	0.00	0.00	0.00
17-2071	Electrical Engineers	6,770	80	20	0.11	0.06	0.04	0.51	0.33
17-2072	Electronics Engineers	2,360	30		0.04	0.02	0.00	0.55	0.00
17-3023	Electrical & Electronic Engineering Technicians	7,990	80	30	0.13	0.06	0.05	0.43	0.42
25-1021	Computer Science Teachers, Postsecondary	2,390	90	20	0.04	0.06	0.04	1.62	0.93
Total, IT Occupations		148,350	1,900	510	2.44	1.34	0.93	0.55	0.38

We can also use these data to explore the composition of the Erie and Sharon IT sectors, as we did above with the 2000 data for WIAs. Table 8 shows each occupation's share of the local economy's IT sector, and a comparison of those numbers to the state breakdown.

Table 8
Estimated 2002 Employment

SOC Code	Occupational Title	Percent of Total Employment			Local % Compared to PA %	
		PA	Erie	Sharon	Erie	Sharon
11-3021	Computer & Information Systems Managers	8.85	9.47	7.84	1.07	0.89
11-9041	Engineering Managers	5.25	6.32	9.80	1.20	1.87
15-1011	Computer & Information Scientists, Research	0.36	0.00	0.00	0.00	0.00
15-1021	Computer Programmers	14.63	11.58	13.73	0.79	0.94
15-1031	Computer Software Engineers, Applications	6.75	4.21	5.88	0.62	0.87
15-1032	Computer Software Engineers, Systems Software	5.06	0.53	1.96	0.10	0.39
15-1041	Computer Support Specialists	13.78	16.84	27.45	1.22	1.99
15-1051	Computer Systems Analysts	12.57	7.37	5.88	0.59	0.47
15-1061	Database Administrators	2.89	4.21	1.96	1.46	0.68
15-1071	Network & Computer Systems Administrators	7.19	13.16	5.88	1.83	0.82
15-1081	Network Systems & Data Communications Analysts	4.14	4.74	1.96	1.14	0.47
15-1099	Computer Specialists, Other	4.35	6.84	3.92	1.57	0.90
17-2061	Computer Hardware Engineers	1.03	0.00	0.00	0.00	0.00
17-2071	Electrical Engineers	4.56	4.21	3.92	0.92	0.86
17-2072	Electronics Engineers	1.59	1.58	0.00	0.99	0.00
17-3023	Electrical & Electronic Engineering Technicians	5.39	4.21	5.88	0.78	1.09
25-1021	Computer Science Teachers, Postsecondary	1.61	4.74	3.92	2.94	2.43
Total, IT Occupations		100.00	100.00	100.00	1.00	1.00

The table above shows that both Erie and Sharon have significant concentrations in Comp Sci Postsecondary Teachers (25-1021), Computer Support Specialists (15-1041), and Engineering Managers (11-9041). Erie also has specializations in Systems Administrators (SOC 15-1071), Database Administrators (15-1061), and the catchall category of Other Computer Specialists (15-1099).

b. U.S. Bureau of Labor Statistics (BLS) Data

The U.S. Bureau of Labor Statistics also publishes occupational data for metro areas. They recently released their estimates for May 2004. The BLS numbers are built on the data gathered by cooperating state agencies, so they should be comparable with the data from L&I. The two agencies are on different schedules and release their data in slightly different formats, however. Most surprisingly, while L&I releases wage data from this survey, they apparently do not post the employment data on their website. The L&I site directs users to the employment estimates from their Long-Term Projections program, which apparently uses a different methodology and runs a year or two later. This means that the BLS is the source for more current employment data, and for a database that provides both employment and wage data. The BLS program also gives comparable data for the U.S., which allows the national comparisons that are unavailable from the L&I site. Table 9 below presents the BLS employment data for the two regional MSAs, as well as Pennsylvania and national data, for May 2004.

**Table 9
BLS 2004 Employment Data**

SOC	Occupational Title	May 2004 Employment				Percent of Total Employment				Location Quotients		
		US	PA	Erie	Sharon	US	PA	Erie	Sharon	PA	Erie	Sharon
00-0000	All Occupations	128,127,360	5,507,880	127,420	48,200	100.00	100.00	100.00	100.00	1.00	1.00	1.00
11-3021	Computer and information systems managers	267,390	12,200	130	30	0.21	0.22	0.10	0.06	1.06	0.49	0.30
11-9041	Engineering managers	186,380	7,790	130		0.15	0.14	0.10	0.00	0.97	0.70	0.00
15-1011	Computer and information scientists, research	24,720	470			0.02	0.01	0.00	0.00	0.44	0.00	0.00
15-1021	Computer programmers	412,090	17,100	220	90	0.32	0.31	0.17	0.19	0.97	0.54	0.58
15-1031	Computer software engineers, applications	425,890	11,050	150		0.33	0.20	0.12	0.00	0.60	0.35	0.00
15-1032	Computer software engineers, systems software	318,020	11,060	50		0.25	0.20	0.04	0.00	0.81	0.16	0.00
15-1041	Computer support specialists	488,540	18,910	380		0.38	0.34	0.30	0.00	0.90	0.78	0.00
15-1051	Computer systems analysts	489,130	18,800	160		0.38	0.34	0.13	0.00	0.89	0.33	0.00
15-1061	Database administrators	96,960	3,610	60		0.08	0.07	0.05	0.00	0.87	0.62	0.00
15-1071	Network and computer systems administrators	259,320	12,210	260	50	0.20	0.22	0.20	0.10	1.10	1.01	0.51
15-1081	Network systems and data communications analysts	169,200	5,040	120		0.13	0.09	0.09	0.00	0.69	0.71	0.00
15-1099	Computer specialists, all other	130,420	4,340	40		0.10	0.08	0.03	0.00	0.77	0.31	0.00
17-2061	Computer hardware engineers	74,760	1,980			0.06	0.04	0.00	0.00	0.62	0.00	0.00
17-2071	Electrical engineers	148,310	6,120	50	40	0.12	0.11	0.04	0.08	0.96	0.34	0.72
17-2072	Electronics engineers, except computer	135,560	3,350	30		0.11	0.06	0.02	0.00	0.57	0.22	0.00
17-3023	Electrical and electronic engineering technicians	178,560	6,190	60		0.14	0.11	0.05	0.00	0.81	0.34	0.00
25-1021	Computer science teachers, postsecondary	37,260	1,780	70		0.03	0.03	0.05	0.00	1.11	1.89	0.00
	Total, IT occupations	3,842,510	142,000	1,910	210	3.00	2.58	1.50	0.44	0.86	0.50	0.15

One drawback of the BLS data is that they are not as occupationally detailed as are the L&I data. Notice that there are only data for four detailed occupations of our list of seventeen IT occupations, while the L&I data report data for fourteen in 2002. For Erie, both data bases report values for fifteen of the seventeen occupations, with the same two missing—presumably indicating a lack of employment in those occupations.

Despite their differences, these two databases tell substantially the same story for several key issues. Most importantly, the local areas typically have significantly smaller shares of their labor forces in the IT sector than the state or the nation. In fact, the BLS database shows that the state—the basis for comparison in the previous analysis—actually has a lower than average share of its employment in IT: 2.58% versus 3.00% nationally. Erie’s and Sharon’s shares are also significantly lower than the national average at 1.50% and 0.44%, according to the BLS database. These translate to LQs less than 1.0 for PA, Erie and Sharon. (Note that Erie and Sharon had 1.34% and 0.93% in the IT sectors, respectively, in the L&I database for 2002.)

The individual occupations show similar patterns in the BLS data as in the Labor and Industry data: only the “Network & Computer Systems Administrators” and the “Computer Science Teachers, Postsecondary” categories have LQs greater than one, even though this table uses the national patterns as the basis for comparison. Again, it is only in the Computer Science Teachers-Postsecondary category that Erie stands out

The BLS database also lets us take a look at the structure within the local IT sector—as well as the state’s—compared to the nation’s. The BLS database gives less data for detailed occupations, especially for Sharon, so these numbers perhaps are not as useful as the PA Labor and Industry data given above. But again, they allow us to make some comparisons with national data as well as state data.

Table 10
Structure of the IT Sector, 2004

SOC	Occupational Title	Percent of IT Sector Empt				Local % compared to US%			
		US	PA	Erie	Sharon	US	PA	Erie	Sharon
11-3021	Computer and information systems managers	6.96	8.59	6.81	14.29	1.00	1.23	0.98	2.05
11-9041	Engineering managers	4.85	5.49	6.81	0.00	1.00	1.13	1.40	0.00
15-1011	Computer and information scientists, research	0.64	0.33	0.00	0.00	1.00	0.51	0.00	0.00
15-1021	Computer programmers	10.72	12.04	11.52	42.86	1.00	1.12	1.07	4.00
15-1031	Computer software engineers, applications	11.08	7.78	7.85	0.00	1.00	0.70	0.71	0.00
15-1032	Computer software engineers, systems software	8.28	7.79	2.62	0.00	1.00	0.94	0.32	0.00
15-1041	Computer support specialists	12.71	13.32	19.90	0.00	1.00	1.05	1.56	0.00
15-1051	Computer systems analysts	12.73	13.24	8.38	0.00	1.00	1.04	0.66	0.00
15-1061	Database administrators	2.52	2.54	3.14	0.00	1.00	1.01	1.24	0.00
15-1071	Network and computer systems administrators	6.75	8.60	13.61	23.81	1.00	1.27	2.02	3.53
15-1081	Network systems and data communications analysts	4.40	3.55	6.28	0.00	1.00	0.81	1.43	0.00
15-1099	Computer specialists, all other	3.39	3.06	2.09	0.00	1.00	0.90	0.62	0.00
17-2061	Computer hardware engineers	1.95	1.39	0.00	0.00	1.00	0.72	0.00	0.00
17-2071	Electrical engineers	3.86	4.31	2.62	19.05	1.00	1.12	0.68	4.93
17-2072	Electronics engineers, except computer	3.53	2.36	1.57	0.00	1.00	0.67	0.45	0.00
17-3023	Electrical and electronic engineering technicians	4.65	4.36	3.14	0.00	1.00	0.94	0.68	0.00
25-1021	Computer science teachers, postsecondary	0.97	1.25	3.66	0.00	1.00	1.29	3.78	0.00
Total, IT occupations		100.00	100.00	100.00	100.00				

Table 10 above shows that both Erie and Sharon have significant concentrations in Systems Administrators (SOC 15-1071) and Programmers (15-1021). Erie’s concentration in Postsecondary Comp Sci Teachers shows up, of course, and it is clear that Erie’s specialization in this occupation is stronger than the state’s. Erie also has relative specializations in Computer Support Specialists (15-1041), Network Systems and Data Communications Analysts (15-1081), Engineering Managers (11-9041) and Database Administrators (15-1061). The comparable data for Sharon may be a little suspect; there are only a few detailed occupations for which the BLS database actually has data for Sharon, so those few automatically show up as large percentages of the total.

B) IT WAGES

A second key measure for IT occupations locally is the level of their wages. In part, workers may judge the quality of a job by the level of wage it pays. But wages can be viewed as a double-edged sword; a higher wage may mean a higher standard of living to the worker, but it also means a higher cost of production for the hiring firm. This will be discussed in greater detail below.

1) Pennsylvania Department of Labor and Industry Data

In cooperation with the U.S. Department of Labor, the PA Department of Labor and Industry conducts an annual survey of a sample of approximately 17,000 PA employers.⁷ Wage data results from this survey, and L&I supplied us with those data for November 2003 for the fourteen-county region of interest to us, including data for WIAs and the fourteen counties individually.

⁷Details of the survey methodology are presented in Appendix C. We should note that the wage data do NOT include the value of fringe benefits.

The wage data in Table 11 show that, with a very few exceptions, IT wages tend to be lower in the northwest Pennsylvania region than the state average. But it is necessary to be careful in making these kinds of comparisons, for several reasons. First, it is possible that workers within an individual SOC code may actually be doing different jobs, some of which require more skill or experience than others. If this is the case, workers within the same SOC code at different places may have different wages because of these other factors that logically justify some or all of the difference.

Table 11
Wages in IT Occupations, November 2003

SOC Code	Occupational Title	PA	NW WIA		WC WIA		NC WIA	
		Average Annual Wage	Average Annual Wage	WIA wage as % of PA	Average Annual Wage	WIA wage as % of PA	Average Annual Wage	WIA wage as % of PA
11-3021	Computer & Information Systems Managers	\$87,350	\$62,084	71.1	\$71,776	82.2	\$78,339	89.7
11-9041	Engineering Managers	92,020	72,530	78.8	76,129	82.7	88,370	96.0
15-1011	Computer & Information Scientists, Research	80,210						
15-1021	Computer Programmers	58,800	66,138	112.5	52,277	88.9	48,734	82.9
15-1031	Computer Software Engineers, Applications	68,590	63,506	92.6	53,963	78.7	70,163	102.3
15-1032	Computer Software Engineers, Systems Software	75,120	68,191	90.8	61,742	82.2		
15-1041	Computer Support Specialists	39,890	34,011	85.3			38,337	96.1
15-1051	Computer Systems Analysts	64,460	54,376	84.4	48,848	75.8	46,941	72.8
15-1061	Database Administrators	60,270	54,190	89.9	50,152	83.2		
15-1071	Network & Computer Systems Administrators	56,910	51,907	91.2	45,133	79.3	45,623	80.2
15-1081	Network Systems & Data Communications Analysts	60,940	48,728	80.0	48,332	79.3	46,829	76.8
15-1099	Computer Specialists, Other	53,350	44,136	82.7	33,960	63.7		
17-2061	Computer Hardware Engineers	75,670					64,683	85.5
17-2071	Electrical Engineers	69,530	56,242	80.9	51,277	73.7	55,713	80.1
17-2072	Electronics Engineers, Ex. Computer	66,050	57,028	86.3			52,987	80.2
17-3023	Electrical & Electronic Engineering Technicians	43,360	38,062	87.8	36,669	84.6	35,926	82.9
25-1021	Computer Science Teachers, Postsecondary	61,950	61,549	99.4				
Average:		\$65,557	\$55,512	87.6	\$52,522	79.5	\$56,054	85.5

Second, there are different numbers of workers in each of the SOC categories and regions, but the averages at the bottoms of the columns in Table 11 are simple averages of the occupational categories, not weighted averages incorporating the number of workers in each profession. Thus it is not really appropriate to say that the average IT worker in the Northwest Workforce Investment Area makes \$55,512; if most local workers happened to be in a high paying SOC like 15-1032, Systems Software Engineering, then the average would be much higher than that \$55,512 average. Alternately, if the Northwest WIA is a hotbed of the lower-paid Computer Support Specialists (SOC 15-1041) then the true average would actually be quite a bit lower than the \$55,512 average. Without numbers of employees/jobs in each category, we cannot calculate the weighted average we'd like to have. Nevertheless, it may be useful to look at how these averages—with all their potential problems—differ across places.

A third reason for caution when working with wage data is that the cost of living varies significantly across the state, and this implies that wages would need to be higher in some places simply to offset the higher cost of living. To help evaluate this influence, Table 12 presents cost of living (COL) estimates for the 67 counties of the state from a 2000 study, with the fourteen counties of interest to us highlighted in yellow. Review of these data show that the northwest Pennsylvania region is a relatively low cost place to live. The fourteen counties averaged 100.2, compared to the state average of 101.5. Six of the fourteen local counties had cost of living indexes below 100, and the highest index for any local county was only 101.0. Contrast that with Philadelphia's index of 127.6 or Delaware's 108.4, and it becomes clear that lower

Table 12
Cost of Living Estimates for Pennsylvania Counties:

County	COL Index	County	COL Index	County	COL Index
Adams	101.9	Delaware	108.4	Montgomery	105.0
Allegheny	104.6	Elk	99.7	Montour	100.6
Armstrong	100.2	Erie	101.0	Northampton	102.5
Beaver	101.0	Fayette	100.5	Northumberland	100.0
Bedford	100.4	Forest	101.0	Perry	101.3
Berks	102.0	Franklin	101.2	Philadelphia	127.6
Blair	100.6	Fulton	101.2	Pike	103.2
Bradford	100.5	Greene	100.1	Potter	100.2
Bucks	103.5	Huntingdon	100.2	Schuylkill	100.0
Butler	101.7	Indiana	100.0	Snyder	100.6
Cambria	100.2	Jefferson	100.2	Somerset	100.5
Cameron	99.7	Juniata	100.9	Sullivan	100.1
Carbon	101.0	Lackawanna	100.7	Susquehanna	100.5
Centre	101.1	Lancaster	102.3	Tioga	100.4
Chester	103.1	Lawrence	100.6	Union	100.5
Clarion	99.7	Lebanon	101.4	Venango	99.9
Clearfield	100.4	Lehigh	103.1	Warren	99.7
Clinton	100.1	Luzerne	100.4	Washington	100.7
Columbia	100.3	Lycoming	100.1	Wayne	101.2
Crawford	100.6	McKean	99.7	Westmoreland	100.9
Cumberland	101.7	Mercer	100.6	Wyoming	99.8
Dauphin	101.5	Mifflin	100.7	York	102.1
		Monroe	103.2		

State average: 101.5

Note: a COL index value of 100 represents the average cost of living in 321 urban areas that participated in the ACCRA *Cost of Living Index*, third quarter, 1997. The ACCRA COLI is based on a survey that prices approximately 60 items covering most categories of living costs, excluding taxes.

Source:

Kurre, James A. *Differences in the Cost of Living Across Pennsylvania's 67 Counties*. Erie, PA: Penn State University at Erie, for the Center for Rural Pennsylvania, March 2000. (Available online at www.ruralpa.org.)

(nominal) wages do not necessarily mean a lower standard of living for IT workers. In fact, these data suggest that a worker in Philadelphia would have to earn 27.3% more than the average worker in the northwest Pennsylvania region to have the same standard of living, once the difference in cost of living is taken into account.

On the other side of the paycheck, though, a lower wage cost can be an important location factor for firms that hire IT workers. Since they may sell their products and services literally anywhere in the world, they are not primarily concerned with the cost of living in the area of their production facility—only the cost of hiring workers there. Thus a low COL can help to make an area very attractive to firms since they are able to pay lower wages there, making them more competitive in world markets. At the same time, the lower wage would not necessarily mean a lower standard of living for the workers, depending on the degree to which they face lower costs, too. Thus a low cost-of-living can present a real opportunity for economic development, a win-win situation.

In northwest Pennsylvania Workforce Investment Areas, wages in the IT occupations averaged 14% to 20% below statewide averages, while cost of living was typically only a few percent below state average. This implies lower real wage levels for IT workers locally compared to other parts of the state. The low wages locally represent a real opportunity for firms that hire IT workers, but the low real wages (after adjusting for COL differences) also make the region less attractive to IT workers. It would not be surprising to see IT workers who are trained here leaving the area, as a result—unless there are other, compensating differentials that would make those workers willing to accept a lower standard of living.

Within the IT sector, some occupations pay substantially more than others. Table 13 presents the IT occupations ranked by their statewide average incomes, with highest-paid professions at the top of the list. This again serves to point out that the IT sector is not homogeneous; In Pennsylvania, the top paid IT occupation earns 2.3 times as much as the lowest-paid IT occupation.

Table 13
IT Occupations Ranked by Wage
Pennsylvania November 2003

Rank	SOC Code	Occupational Title	Average Annual Wage
1	11-9041	Engineering Managers	\$92,020
2	11-3021	Computer & Information Systems Managers	87,350
3	15-1011	Computer & Information Scientists, Research	80,210
4	17-2061	Computer Hardware Engineers	75,670
5	15-1032	Computer Software Engineers, Systems Software	75,120
6	17-2071	Electrical Engineers	69,530
7	15-1031	Computer Software Engineers, Applications	68,590
8	17-2072	Electronics Engineers, Ex. Computer	66,050
9	15-1051	Computer Systems Analysts	64,460
10	25-1021	Computer Science Teachers, Postsecondary	61,950
11	15-1081	Network Systems & Data Communications Analysts	60,940
12	15-1061	Database Administrators	60,270
13	15-1021	Computer Programmers	58,800
14	15-1071	Network & Computer Systems Administrators	56,910
15	15-1099	Computer Specialists, Other	53,350
16	17-3023	Electrical & Electronic Engineering Technicians	43,360
17	15-1041	Computer Support Specialists	39,890

Does the local area tend to specialize in either the high- or low-wage end of the IT spectrum? Table 14 helps to answer that question by recalling location quotients for 2000 from Table 6. In Table 14, yellow cells are those with LQs greater than 1.20, showing substantial specializations. For the region as a

whole, and the Northwest and North Central WIAs, the IT jobs tend to be spread across both high- and low-paying jobs. But IT jobs in the West Central region tend to be more specialized at the lower end of the wage spectrum.

Table 14
Occupations Ranked by Wage and
Relative Importance of Each Occupation

Rank	SOC Code	Occupational Title	Average Annual Wage	PA	Location Quotients			
				% of IT sector	Sum of WIAs	NW	NC	WC
1	11-9041	Engineering Managers	\$92,020	6.1	1.56	1.57	1.80	1.16
2	11-3021	Computer & Information Systems Managers	87,350	9.2	1.03	0.95	1.26	0.89
3	15-1011	Computer & Information Scientists, Research	80,210	0.3	0.00	0.00	0.00	0.00
4	17-2061	Computer Hardware Engineers	75,670	0.7	1.63	2.43	1.01	0.00
5	15-1032	Computer Software Engineers, Systems Software	75,120	5.2	0.15	0.07	0.14	0.45
6	17-2071	Electrical Engineers	69,530	4.9	1.21	1.59	0.75	0.72
7	15-1031	Computer Software Engineers, Applications	68,590	6.7	0.41	0.53	0.11	0.53
8	17-2072	Electronics Engineers, Ex. Computer	66,050	1.8	0.96	0.76	1.98	0.00
9	15-1051	Computer Systems Analysts	64,460	13.0	0.68	0.62	0.45	1.27
10	25-1021	Computer Science Teachers, Postsecondary	61,950	1.2	1.17	2.08	0.00	0.00
11	15-1081	Network Systems & Data Communications Analysts	60,940	3.2	1.71	1.74	2.26	0.73
12	15-1061	Database Administrators	60,270	2.8	0.92	1.00	1.04	0.42
13	15-1021	Computer Programmers	58,800	14.3	0.77	0.91	0.51	0.74
14	15-1071	Network & Computer Systems Administrators	56,910	6.4	1.17	1.31	1.02	0.91
15	15-1099	Computer Specialists, Other	53,350	5.0	1.02	0.91	1.01	1.40
16	17-3023	Electrical & Electronic Engineering Technicians	43,360	6.9	1.03	1.02	1.16	0.85
17	15-1041	Computer Support Specialists	39,890	12.1	1.60	1.22	2.05	2.14

2) U.S. Bureau of Labor Statistics (BLS) Data

As with the employment data, we have MSA data on wages in IT professions for the nation, the state and the MSAs in our study area, but not for other counties separately or for WIAs. These data, presented in Table 15, are more current as well, reflecting wage patterns as of May 2004 (instead of November 2003 for the L&I data.)

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**Table 15
Annual IT Wages, May 2004**

SOC	Occupational Title	US	PA	Erie MSA	Sharon MSA
00-0000	All Occupations	\$37,020	\$35,780	\$31,880	\$29,230
11-3021	Computer and information systems managers	98,260	91,440	68,360	71,840
11-9041	Engineering managers	102,600	97,010	72,720	
15-1011	Computer and information scientists, research	88,020	87,640		
15-1021	Computer programmers	65,910	60,140	62,630	49,140
15-1031	Computer software engineers, applications	77,330	72,720	57,410	
15-1032	Computer software engineers, systems software	82,160	76,650	60,990	
15-1041	Computer support specialists	43,620	40,650	34,160	
15-1051	Computer systems analysts	68,370	66,320	52,210	
15-1061	Database administrators	63,460	60,320	55,430	
15-1071	Network and computer systems administrators	61,470	59,330	53,320	43,690
15-1081	Network systems and data communications analysts	63,410	60,980	50,930	
15-1099	Computer specialists, all other	63,030	53,930		
17-2061	Computer hardware engineers	84,010	81,500		
17-2071	Electrical engineers	74,220	71,530	56,300	53,220
17-2072	Electronics engineers, except computer	77,450	78,540	66,370	
17-3023	Electrical and electronic engineering technicians	47,130	44,940	40,950	
25-1021	Computer science teachers, postsecondary	58,140	62,890	58,750	
	Average:	\$71,682	\$68,619	\$56,466	\$54,473
	Compared to "all occupations":	1.94	1.92	1.77	1.86

Table 15 also presents the average annual wage for all occupations, allowing confirmation that IT jobs tend to pay significantly better than average, in all the areas considered. At the national level, the lowest-paid IT category, Computer support Specialist (SOC 15-1041), paid about 18% more than the average job. At the other end of the spectrum, Engineering Managers (SOC 11-9041) were paid 2.8 times the average wage. The last two rows of the table give simple averages of the wage numbers, and compare the average for the IT occupations to that for "All Occupations". On average, IT jobs paid nearly double the average in both the U.S. and the state,. While the ratio was a little lower in the Erie and Sharon MSAs, investment in IT education still seems to be a good investment.

Patterns in the BLS data in Table 15 are similar to those seen in the preceding table with L&I data. The Manager occupations (SOC 11-) were the highest paid in all areas, and the Erie and Sharon wage rates were quite a bit below both the PA and U.S. wage rates, with rare exceptions. This database also allows a comparison of Pennsylvania wages with national wages, and we see that state wages in the IT sector were below the national average for all but two occupations (Electronics Engineers and Postsecondary Computer Science Teachers.)

Table 16
Annual IT Wages as a Percent of U.S. Wages, May 2004

SOC	Occupational Title	PA	Erie MSA	Sharon MSA
00-0000	All Occupations	96.7	86.1	79.0
11-3021	Computer and information systems managers	93.1	69.6	73.1
11-9041	Engineering managers	94.6	70.9	
15-1011	Computer and information scientists, research	99.6		
15-1021	Computer programmers	91.2	95.0	74.6
15-1031	Computer software engineers, applications	94.0	74.2	
15-1032	Computer software engineers, systems software	93.3	74.2	
15-1041	Computer support specialists	93.2	78.3	
15-1051	Computer systems analysts	97.0	76.4	
15-1061	Database administrators	95.1	87.3	
15-1071	Network and computer systems administrators	96.5	86.7	71.1
15-1081	Network systems and data communications analysts	96.2	80.3	
15-1099	Computer specialists, all other	85.6		
17-2061	Computer hardware engineers	97.0		
17-2071	Electrical engineers	96.4	75.9	71.7
17-2072	Electronics engineers, except computer	101.4	85.7	
17-3023	Electrical and electronic engineering technicians	95.4	86.9	
25-1021	Computer science teachers, postsecondary	108.2	101.0	
	Average:	95.7	81.6	72.6

C) IT EMPLOYMENT PROJECTIONS

The data to this point have been for the “current” (i.e., recent past) time period. But it would be useful to look into the future of the IT professions. What is expected to happen in these fields? The PA Department of Labor and Industry biennially prepares a set of 10-year employment projections by occupation, and these may give us some clues as to what to expect. Appendix D presents information on how L&I prepares their projections.

1) Workforce Investment Areas

For Workforce Investment Areas the most recent forecasts available are for the period 2000-2010. (Projections for the 2002-2012 period are expected to be available later this summer.) L&I’s expectations for the region are presented in the tables below.

Table 17
Projected 2010 Employment in IT Occupations

SOC Code	Occupational Title	Projected Employment 2010				
		PA	Sum of WIAs	NW	NC	WC
00-0000	Total, All Occupations	6,399,600	453,750	259,210	100,410	94,130
11-3021	Computer & Information Systems Managers	17,850	580	310	190	80
11-9041	Engineering Managers	8,350	410	230	120	60
15-1011	Computer & Information Scientists, Research	500	0			
15-1021	Computer Programmers	20,700	510	360	80	70
15-1031	Computer Software Engineers, Applications	15,450	200	160	10	30
15-1032	Computer Software Engineers, Systems Software	11,550	40	10	10	20
15-1041	Computer Support Specialists	30,200	1,530	700	500	330
15-1051	Computer Systems Analysts	25,100	530	300	90	140
15-1061	Database Administrators	5,750	160	110	40	10
15-1071	Network & Computer Systems Administrators	14,750	540	360	120	60
15-1081	Network Systems & Data Communications Analysts	7,050	410	260	130	20
15-1099	Computer Specialists, Other	10,350	320	170	80	70
17-2061	Computer Hardware Engineers	1,050	50	40	10	
17-2071	Electrical Engineers	6,900	260	200	40	20
17-2072	Electronics Engineers, Ex. Computer	2,750	90	40	50	
17-3023	Electrical & Electronic Engineering Technicians	9,750	340	190	100	50
25-1021	Computer Science Teachers, Postsecondary	2,100	80	80		
Total, IT occupations		190,150	6,050	3,520	1,570	960

Table 18 below shows that L&I expects employment to grow by 4.5% overall in Pennsylvania in the first decade of the millennium, but only by 0.7% in the northwest region. (Perhaps we should mention that that's 0.7% for the whole ten-year period, not an annual rate of growth.) Again, we see the pattern of slower than average growth in the region. Within the region, L&I expects the Northwest WIA to grow by 3.7%, but the North Central and West Central WIAs to actually shrink in employment, the North Central region by 5.3% or nearly 5,600 jobs. This points out that the fourteen-county northwest region clearly is not homogeneous; parts of it are expected to have a much worse time of it in this decade than others.

While expectations for the overall employment picture are not glowing, the IT occupations generally exhibit a much rosier scenario. Overall, L&I expects the IT occupations in the three WIAs to grow by 19.6%, which is a whopping 28 times faster than overall employment. In the Northwest WIA they expect IT job growth of nearly 24%, and almost 15% growth in the North Central WIA. Even in the declining West Central WIA, IT jobs are expected to increase by nearly 13%. Clearly, IT is a bright spot for the economies of northwest Pennsylvania. (IT is it?)

Table 18
Projected Rates of Change in Employment in IT Occupations, 2000-2010

SOC Code	Occupational Title	Projected Rate of Change in Employment, 2000-2010				
		PA	Sum of WIAs	NW	NC	WC
00-0000	Total, All Occupations	4.5	0.7	3.7	-5.3	-0.6
11-3021	Computer & Information Systems Managers	27.5	20.8	24.0	18.8	14.3
11-9041	Engineering Managers	-9.2	-14.6	-14.8	-20.0	0.0
15-1011	Computer & Information Scientists, Research	25.0				
15-1021	Computer Programmers	-4.8	-8.9	-2.7	-20.0	-22.2
15-1031	Computer Software Engineers, Applications	52.2	42.9	60.0	0.0	0.0
15-1032	Computer Software Engineers, Systems Software	45.3	0.0	0.0	0.0	0.0
15-1041	Computer Support Specialists	64.6	56.1	66.7	47.1	50.0
15-1051	Computer Systems Analysts	27.4	17.8	30.4	12.5	0.0
15-1061	Database Administrators	35.3	23.1	37.5	0.0	0.0
15-1071	Network & Computer Systems Administrators	51.3	42.1	50.0	33.3	20.0
15-1081	Network Systems & Data Communications Analysts	43.9	46.4	62.5	30.0	0.0
15-1099	Computer Specialists, Other	35.3	23.1	30.8	14.3	16.7
17-2061	Computer Hardware Engineers	-4.5	-16.7	-20.0	0.0	
17-2071	Electrical Engineers	-6.8	-13.3	-9.1	-20.0	-33.3
17-2072	Electronics Engineers, Ex. Computer	-1.8	0.0	0.0	0.0	
17-3023	Electrical & Electronic Engineering Technicians	-6.7	-5.6	-5.0	-9.1	0.0
25-1021	Computer Science Teachers, Postsecondary	16.7	14.3	14.3		
	Total, IT occupations	25.4	19.6	23.9	14.6	12.9

This is not to say that all IT occupations are expected to grow in all areas. There are nearly a dozen negative growth rates mixed among the seventeen industries in the three WIAs listed in Table 18. All the non-computer engineering occupations are expected to shrink statewide and in the region, as is the Computer Programmer profession. But most of the other IT sectors are expected to see generous double-digit growth rates. In fact, they are expected to be among the fastest-growing sectors statewide. Table 19 shows the occupations with the top 25 expected growth rates in the state, according to L&I's 2000-2010 projections. Ten of those 25 are IT occupations (highlighted in yellow), including seven of the top ten. Moreover, the IT occupations are often ones with significant amounts of employment.

Table 19
Expected Job Growth, Pennsylvania,
Ranked by Growth Rate, 2000-2010

Rank	SOC Code	Occupational Title	Employment		
			Estimated 2000	Projected 2010	Percent Change
	00-0000	Total, All Occupations	6,125,800	6,399,600	4.5
1	53-4012	Locomotive Firers	50	100	100.0
2	15-1041	Computer Support Specialists	18,350	30,200	64.6
3	15-1031	Computer Software Engineers, Applications	10,150	15,450	52.2
4	15-1071	Network & Computer Systems Administrators	9,750	14,750	51.3
5	43-9031	Desktop Publishers	2,000	2,950	47.5
6	15-1032	Computer Software Engineers, Systems Software	7,950	11,550	45.3
7	15-1081	Network Systems & Data Communications Analysts	4,900	7,050	43.9
8	39-9021	Personal & Home Care Aides	16,250	22,050	35.7
9	15-1061	Database Administrators	4,250	5,750	35.3
10	15-1099	Computer Specialists, Other	7,650	10,350	35.3
11	21-1093	Social & Human Service Assistants	12,100	16,250	34.3
12	45-2091	Agricultural Equipment Operators	150	200	33.3
13	53-2012	Commercial Pilots	450	600	33.3
14	29-2041	Emergency Medical Technicians & Paramedics	14,200	18,650	31.3
15	25-2041	Special Education Teachers, Preschool, Kindergarten &	8,750	11,400	30.3
16	31-9092	Medical Assistants	12,800	16,650	30.1
17	29-1071	Physician Assistants	2,350	3,050	29.8
18	29-2052	Pharmacy Technicians	10,000	12,950	29.5
19	25-1064	Geography Teachers, Postsecondary	350	450	28.6
20	29-1126	Respiratory Therapists	3,850	4,950	28.6
21	11-3021	Computer & Information Systems Managers	14,000	17,850	27.5
22	15-1051	Computer Systems Analysts	19,700	25,100	27.4
23	29-2031	Cardiovascular Technologists & Technicians	2,350	2,950	25.5
24	15-1011	Computer & Information Scientists, Research	400	500	25.0
25	17-2031	Biomedical Engineers	400	500	25.0

All this implies that there are significant opportunities in the IT sector, compared to other sectors, both statewide and in the northwest Pennsylvania region.

But the just-released statewide projections for the 2002-2012 period change this picture somewhat. These newer projections anticipate a 6.3% overall growth rate over the 2002-2012 period, compared with a 4.5% rate in the 2000-2010 period. However, expected growth rates for the IT occupations are lower in the new projections. Table 20 shows that the expected growth rate for the IT sector overall fell from 25.4% to 19.7% in the newer period. While this is slower than projected previously, we should note that growth in IT jobs is still expected to be over three times the average for the state. And while many of the IT occupations saw a slowdown in their projected rates of growth, others experienced an increase, including Computer Programmers, C&IS Managers, Network Systems and Data Communications Analysts, and many of the engineering categories.

Table 20
Expected IT Job Growth, Pennsylvania, 2002-2012

SOC Code	Occupational Title	Expected % Change	
		2000-10	2002-12
00-0000	Total, All Occupations	4.5	6.3
11-3021	Computer & Information Systems Managers	27.3	24.2
11-9041	Engineering Managers	-9.3	3.7
15-1011	Computer & Information Scientists, Research	13.9	16.7
15-1021	Computer Programmers	-4.9	4.0
15-1031	Computer Software Engineers, Applications	52.6	38.4
15-1032	Computer Software Engineers, Systems Software	44.9	33.9
15-1041	Computer Support Specialists	64.3	18.5
15-1051	Computer Systems Analysts	27.6	24.5
15-1061	Database Administrators	35.0	34.1
15-1071	Network & Computer Systems Administrators	51.4	24.4
15-1081	Network Systems & Data Communications Analysts	43.9	54.7
15-1099	Computer Specialists, Other	35.3	29.7
17-2061	Computer Hardware Engineers	-0.7	-0.7
17-2071	Electrical Engineers	-7.1	-2.7
17-2072	Electronics Engineers	-1.3	8.5
17-3023	Electrical & Electronic Engineering Technicians	-6.7	2.4
25-1021	Computer Science Teachers, Postsecondary	17.8	20.9
Total, IT Occupations		25.4	19.7

In the newer projections, there are only three IT occupations in the top 25 growth industries, as shown in Table 21.

Table 21
Expected Job Growth, Pennsylvania,
Ranked by Growth Rate, 2002-2012

Rank	SOC Code	Occupational Title	Employment		
			Estimated 2002	Projected 2012	Percent Change
	00-0000	Total, All Occupations	6,088,520	6,474,900	6.3
1	41-2012	Gaming Change Persons & Booth Cashiers	60	130	116.7
2	11-9071	Gaming Managers	30	50	66.7
3	53-2099	Air Transportation Workers, All Other	380	590	55.3
4	15-1081	Network Systems & Data Communications Analysts	6,140	9,500	54.7
5	31-9092	Medical Assistants	16,480	24,050	45.9
6	49-9095	Manufactured Building & Mobile Home Installers	550	770	40.0
7	21-1093	Social & Human Service Assistants	14,250	19,790	38.9
8	13-2052	Personal Financial Advisors	7,080	9,810	38.6
9	15-1031	Computer Software Engineers, Applications	10,010	13,850	38.4
10	25-3021	Self-Enrichment Education Teachers	5,740	7,890	37.5
11	39-3012	Gaming and Sports Book Writers & Runners	510	700	37.3
12	31-1011	Home Health Aides	23,690	32,310	36.4
13	47-5099	Extraction Workers, Other	110	150	36.4
14	29-1071	Physician Assistants	2,540	3,420	34.6
15	15-1061	Database Administrators	4,280	5,740	34.1
16	15-1032	Computer Software Engineers, Systems Software	7,500	10,040	33.9
17	29-2021	Dental Hygienists	7,100	9,480	33.5
18	31-9091	Dental Assistants	7,910	10,540	33.2
19	31-2012	Occupational Therapist Aides	1,050	1,390	32.4
20	31-9011	Massage Therapists	2,600	3,430	31.9
21	17-2081	Environmental Engineers	1,730	2,270	31.2
22	39-9031	Fitness Trainers & Aerobics Instructors	8,160	10,690	31.0
23	29-2041	Emergency Medical Technicians & Paramedics	13,920	18,170	30.5
24	29-2056	Veterinary Technologists & Technicians	2,230	2,910	30.5
25	19-4091	Environmental Science & Protection Technicians, Incl. Health	970	1,260	29.9

2) Metropolitan Statistical Areas

L&I also makes separate projections for MSAs, and the data for Erie and Sharon are presented in Table 22 below. Both Erie and Sharon are expected to grow at rates slower than the state overall, 5.8% in Erie and 2.4% in Sharon compared with 6.3% statewide. This suggests that there is clearly room for improvement in these MSAs. But the table also shows that the IT growth rate in all three areas is expected to be at least twice or three times the overall rate. Again, IT shows up as a fast growth sector in the MSAs, making it a primary candidate for any economic development strategy.

The table also shows that not every occupation in the IT sector is a fast-growth profession; some are expected to experience no growth or even to shrink, so planning efforts need to take a look at the detail of the sector rather than assuming that everything in the IT area will grow rapidly and continuously.

Table 22
Projected Growth, PA and MSAs, 2002-2012

SOC Code	Occupational Title	Employment			Employment			Employment		
		Est. 2002	Proj. 2012	Percent Change	Est. 2002	Proj. 2012	Percent Change	Est. 2002	Proj. 2012	Percent Change
		PENNSYLVANIA			ERIE MSA			SHARON MSA		
00-0000	Total, All Occupations	6,088,520	6,474,900	6.3	141,800	150,090	5.8	54,890	56,230	2.4
11-3021	Computer & Information Systems Managers	13,130	16,310	24.2	180	230	27.8	40	50	25.0
11-9041	Engineering Managers	7,790	8,080	3.7	120	120	0.0	50	50	0.0
15-1011	Computer & Information Scientists, Research	540	630	16.7						
15-1021	Computer Programmers	21,700	22,570	4.0	220	210	-4.5	70	70	0.0
15-1031	Computer Software Engineers, Applications	10,010	13,850	38.4	80	120	50.0	30	40	33.3
15-1032	Computer Software Engineers, Systems Software	7,500	10,040	33.9	10	10	0.0	10	20	100.0
15-1041	Computer Support Specialists	20,450	24,240	18.5	320	350	9.4	140	130	-7.1
15-1051	Computer Systems Analysts	18,650	23,220	24.5	140	170	21.4	30	30	0.0
15-1061	Database Administrators	4,280	5,740	34.1	80	110	37.5	10	10	0.0
15-1071	Network & Computer Systems Administrators	10,660	13,260	24.4	250	300	20.0	30	30	0.0
15-1081	Network Systems & Data Communications Analysts	6,140	9,500	54.7	90	130	44.4	10	10	0.0
15-1099	Computer Specialists, Other	6,460	8,380	29.7	130	160	23.1	20	30	50.0
17-2061	Computer Hardware Engineers	1,530	1,520	-0.7						
17-2071	Electrical Engineers	6,770	6,590	-2.7	80	80	0.0	20	20	0.0
17-2072	Electronics Engineers	2,360	2,560	8.5	30	30	0.0			
17-3023	Electrical & Electronic Engineering Technicians	7,990	8,180	2.4	80	80	0.0	30	30	0.0
25-1021	Computer Science Teachers, Postsecondary	2,390	2,890	20.9	90	110	22.2	20	20	0.0
	Total, IT Occupations	148,350	177,560	19.7	1,900	2,210	16.3	510	540	5.9

Aside from increase in numbers of jobs in a field due to expansion of business, there are also openings that arise from the need to replace workers who are leaving their jobs, either to take another job or due to retirement or death. Table 23 presents L&I's estimates for replacement need as well as growth in the IT occupations. Consideration of replacement needs typically makes a significant difference in the number of local job openings, usually doubling (or more) the amount of job openings due to growth alone.

Table 23
Growth and Replacement Needs for IT Occupations, 2002-2012

SOC Code	Occupational Title	Openings Due to			Openings Due to			Openings Due to		
		Growth	Replcmt ¹	Total ²	Growth	Replcmt ¹	Total ²	Growth	Replcmt ¹	Total ²
		PENNSYLVANIA			ERIE MSA			SHARON MSA		
00-0000	Total, All Occupations	386,380	1,489,350	1,875,730	8,290	35,730	44,040	1,340	13,870	15,190
11-3021	Computer & Information Systems Managers	3,180	2,400	5,580	50	30	100	10	10	10
11-9041	Engineering Managers	290	1,550	1,840	0	20	0	0	10	0
15-1011	Computer & Information Scientists, Research	90	50	140	0	0	0	0	0	0
15-1021	Computer Programmers	870	5,100	5,970	-10	50	40	0	20	0
15-1031	Computer Software Engineers, Applications	3,840	1,000	4,840	40	10	40	10	0	10
15-1032	Computer Software Engineers, Systems Software	2,540	750	3,290	0	0	0	10	0	10
15-1041	Computer Support Specialists	3,790	2,500	6,290	30	40	80	-10	20	0
15-1051	Computer Systems Analysts	4,570	2,100	6,670	30	20	30	0	0	0
15-1061	Database Administrators	1,460	450	1,910	30	10	30	0	0	0
15-1071	Network & Computer Systems Administrators	2,600	1,200	3,800	50	30	100	0	0	0
15-1081	Network Systems & Data Communications Analysts	3,360	700	4,060	40	10	40	0	0	0
15-1099	Computer Specialists, Other	1,920	750	2,670	30	10	30	10	0	10
17-2061	Computer Hardware Engineers	-10	250	240	0	0	0	0	0	0
17-2071	Electrical Engineers	-180	1,350	1,170	0	20	0	0	10	0
17-2072	Electronics Engineers	200	450	650	0	10	0	0	0	0
17-3023	Electrical & Electronic Engineering Technicians	190	1,650	1,840	0	20	0	0	10	0
25-1021	Computer Science Teachers, Postsecondary	500	550	1,050	20	20	20	0	0	0
Total, IT Occupations		29,210	22,800	52,010	310	300	510	30	80	40

FOOTNOTES:

Data may not add to totals due to rounding. This explains the Total Openings values for Total IT Occupations, the last row of the table.

1. Labor force net replacements due to death, retirement, disability, or withdrawal for personal reasons.

2. Total openings equal replacements plus annual growth, except for cases when negative growth is greater than annual replacements, where total openings are expressed as zero.

Table 24 below shows the expected growth rates for all IT occupations from 2002-2012. It also presents the ratio of local growth to state growth for both MSAs, to make it easier to identify the occupations in which each MSA is expected to do especially well. Erie is expected to grow faster than the state in Computer Systems Software Engineers (SOC 15-1031), C&IS Managers (SOC 11-3021), Database Administrators (SOC 15-1061), and Postsecondary Comp Sci Teachers (SOC 25-1021). Sharon shares these patterns for the first two of those occupations, and adds rapid growth in “Other Computer Specialists” (SOC 15-1099).

Table 24
Projected Growth Rates, 2002-2012

SOC Code	Occupational Title	Expected Percent Change 2002-12			Ratio of Local / PA growth	
		PA	Erie	Sharon	Erie	Sharon
00-0000	Total, All Occupations	6.3	5.8	2.4	0.92	0.38
11-3021	Computer & Information Systems Managers	24.2	27.8	25.0	1.15	1.03
11-9041	Engineering Managers	3.7	0.0	0.0	0.00	0.00
15-1011	Computer & Information Scientists, Research	16.7			0.00	0.00
15-1021	Computer Programmers	4.0	-4.5	0.0	-1.13	0.00
15-1031	Computer Software Engineers, Applications	38.4	50.0	33.3	1.30	0.87
15-1032	Computer Software Engineers, Systems Software	33.9	0.0	100.0	0.00	2.95
15-1041	Computer Support Specialists	18.5	9.4	-7.1	0.51	-0.39
15-1051	Computer Systems Analysts	24.5	21.4	0.0	0.87	0.00
15-1061	Database Administrators	34.1	37.5	0.0	1.10	0.00
15-1071	Network & Computer Systems Administrators	24.4	20.0	0.0	0.82	0.00
15-1081	Network Systems & Data Communications Analysts	54.7	44.4	0.0	0.81	0.00
15-1099	Computer Specialists, Other	29.7	23.1	50.0	0.78	1.68
17-2061	Computer Hardware Engineers	-0.7			0.00	0.00
17-2071	Electrical Engineers	-2.7	0.0	0.0	0.00	0.00
17-2072	Electronics Engineers	8.5	0.0		0.00	0.00
17-3023	Electrical & Electronic Engineering Technicians	2.4	0.0	0.0	0.00	0.00
25-1021	Computer Science Teachers, Postsecondary	20.9	22.2	0.0	1.06	0.00
Total, IT Occupations		19.7	16.3	5.9	0.83	0.30

REFERENCES

- Economics and Statistics Administration, U.S. Department of Commerce. (2003). *Digital Economy 2003*. Washington, D.C., U.S. Department of Commerce. Available online at: <https://www.esa.doc.gov/2003.cfm>.
- Kurre, James A. *Differences in the Cost of Living Across Pennsylvania's 67 Counties*. Erie, PA: Penn State University at Erie, for the Center for Rural Pennsylvania, March 2000. (Available online at www.ruralpa.org.)
- Pennsylvania Department of Labor and Industry. *Long-Term Occupational Employment Projections by Workforce Investment Area*.
Data for 2000-2010 projections for MSAs are online at:
<http://www.dli.state.pa.us/landi/cwp/view.asp?a=140&q=201575>.
Data for 2000-2010 for WIAs are online at:
<http://www.dli.state.pa.us/landi/cwp/view.asp?a=140&q=58432>.
Data for 2002-2012 projections for MSAs and the state were supplied directly to the author from the Department of Labor and Industry.
- U.S. Bureau of Labor Statistics. *Occupational Employment Statistics*. Online at: <http://www.bls.gov/oes/home.htm>.
- U.S. Bureau of Labor Statistics. *Standard Occupational Classification (SOC) System*.
-Interactive, online listing: http://stats.bls.gov/soc/soc_majo.htm.
-Static document: <http://stats.bls.gov/soc/socstruc.pdf>.
-Searchable listing: <http://stats.bls.gov/search/soc.asp>.
- U.S. Census Bureau. *Metropolitan and Micropolitan Statistical Area Definitions*. Online at <http://www.census.gov/population/www/estimates/metrodef.html>.

(Add remainder of data sources.)

Appendix A

Standard Occupational Classification (SOC)

Each occupation in the SOC is placed within one of these 23 major groups, with more digits in the SOC code indicating successive levels of detail.

- 11-0000 Management Occupations
 - 11-3020 Computer and information systems managers
 - 11-9040 Engineering managers
- 13-0000 Business and Financial Operations Occupations
- 15-0000 Computer and Mathematical Occupations
 - 15-1011 Computer and Information Scientists, Research
 - 15-1021 Computer Programmers
 - 15-1030 Computer Software Engineers
 - 15-1031 Computer Software Engineers, Applications
 - 15-1032 Computer Software Engineers, Systems Software
 - 15-1041 Computer Support Specialists
 - 15-1051 Computer Systems Analysts
 - 15-1061 Database Administrators
 - 15-1071 Network and Computer Systems Administrators
 - 15-1081 Network Systems and Data Communications Analysts
 - 15-1090 Miscellaneous Computer Specialists
 - 15-1099 Computer Specialists, All Other
- 17-0000 Architecture and Engineering Occupations
 - 17-2060 Computer hardware engineers
 - 17-2071 Electrical engineers
 - 17-2072 Electronics engineers, except computer
 - 17-3023 Electrical and electronic engineering technicians
- 19-0000 Life, Physical, and Social Science Occupations
- 21-0000 Community and Social Services Occupations
- 23-0000 Legal Occupations
- 25-0000 Education, Training, and Library Occupations
 - 25-1021 Computer Science Teachers, Postsecondary
- 27-0000 Arts, Design, Entertainment, Sports, and Media Occupations
- 29-0000 Healthcare Practitioners and Technical Occupations
- 31-0000 Healthcare Support Occupations
- 33-0000 Protective Service Occupations
- 35-0000 Food Preparation and Serving Related Occupations
- 37-0000 Building and Grounds Cleaning and Maintenance Occupations
- 39-0000 Personal Care and Service Occupations
- 41-0000 Sales and Related Occupations
- 43-0000 Office and Administrative Support Occupations
- 45-0000 Farming, Fishing, and Forestry Occupations
- 47-0000 Construction and Extraction Occupations
- 49-0000 Installation, Maintenance, and Repair Occupations
- 51-0000 Production Occupations
- 53-0000 Transportation and Material Moving Occupations
- 55-0000 Military Specific Occupations

Occupations are classified based upon work performed, skills, education, training, and credentials.

Supervisors of professional and technical workers usually have a background similar to the workers they supervise, and are therefore classified with the workers they supervise. Likewise, team leaders, lead workers and supervisors of production, sales, and service workers who spend at least 20 percent of their time performing work similar to the workers they supervise are classified with the workers they supervise.

First-line managers and supervisors of production, service, and sales workers who spend more than 80 percent of their time performing supervisory activities are classified separately in the appropriate supervisor category, since their work activities are distinct from those of the workers they supervise. First-line managers are generally found in smaller establishments where they perform both supervisory and management functions, such as accounting, marketing, and personnel work.

Appendix B

Information Technology Occupations: Descriptions

11-0000 Management Occupations

11-3020 Computer and information systems managers

Plan, direct, or coordinate activities in such fields as electronic data processing, information systems, systems analysis, and computer programming. Exclude "Computer Specialists" (15-1011 through 15-1099).

11-9040 Engineering managers

Plan, direct, or coordinate activities in such fields as architecture and engineering or research and development in these fields. Exclude "Natural Sciences Managers" (11-9121).

15-0000 Computer and Mathematical Occupations

15-1011 Computer and Information Scientists, Research

Conduct research into fundamental computer and information science as theorists, designers, or inventors. Solve or develop solutions to problems in the field of computer hardware and software.

15-1021 Computer Programmers

Convert project specifications and statements of problems and procedures to detailed logical flow charts for coding into computer language. Develop and write computer programs to store, locate, and retrieve specific documents, data, and information. May program web sites.

15-1030 Computer Software Engineers

15-1031 Computer Software Engineers, Applications

Develop, create, and modify general computer applications software or specialized utility programs. Analyze user needs and develop software solutions. Design software or customize software for client use with the aim of optimizing operational efficiency. May analyze and design databases within an application area, working individually or coordinating database development as part of a team. Exclude "Computer Hardware Engineers" (17-2061).

15-1032 Computer Software Engineers, Systems Software

Research, design, develop, and test operating systems-level software, compilers, and network distribution software for medical, industrial, military, communications, aerospace, business, scientific, and general computing applications. Set operational specifications and formulate and analyze software requirements. Apply principles and techniques of computer science, engineering, and mathematical analysis.

15-1041 Computer Support Specialists

Provide technical assistance to computer system users. Answer questions or resolve computer problems for clients in person, via telephone or from remote location. May provide assistance concerning the use of computer hardware and software, including printing, installation, word processing, electronic mail, and operating systems. Exclude "Network and Computer Systems Administrators" (15-1071).

15-1051 Computer Systems Analysts

Analyze science, engineering, business, and all other data processing problems for application to electronic data processing systems. Analyze user requirements, procedures, and problems to automate or improve existing systems and review computer system capabilities, workflow, and scheduling limitations. May analyze or recommend commercially available software. Exclude persons working primarily as "Engineers" (17-2011 through 17-2199), "Mathematicians" (15-2021), or "Scientists" (19-1011 through 19-3099). May supervise computer programmers.

15-1061 Database Administrators

Coordinate changes to computer databases, test and implement the database applying knowledge of database management systems. May plan, coordinate, and implement security measures to safeguard computer databases.

15-1071 Network and Computer Systems Administrators

Install, configure, and support an organization's local area network (LAN), wide area network (WAN), and Internet system or a segment of a network system. Maintain network hardware and software. Monitor network to ensure network availability to all system users and perform necessary maintenance to support network availability. May supervise other network support and client server specialists and plan, coordinate, and implement network security measures. Exclude "Computer Support Specialists" (15-1041).

- 15-1081 Network Systems and Data Communications Analysts
Analyze, design, test, and evaluate network systems, such as local area networks (LAN), wide area networks (WAN), Internet, intranet, and other data communications systems. Perform network modeling, analysis, and planning. Research and recommend network and data communications hardware and software. Include telecommunications specialists who deal with the interfacing of computer and communications equipment. May supervise computer programmers.
- 15-1090 Miscellaneous Computer Specialists
15-1099 Computer Specialists, All Other
All computer specialists not listed separately.
- 17-0000 Architecture and Engineering Occupations
- 17-2060 Computer hardware engineers
Research, design, develop, and test computer or computer-related equipment for commercial, industrial, military, or scientific use. May supervise the manufacturing and installation of computer or computer-related equipment and components. Exclude "Computer Software Engineers, Applications" (15-1031) and "Computer Software Engineers, Systems Software" (15-1032).
- 17-2071 Electrical engineers
Design, develop, test, or supervise the manufacturing and installation of electrical equipment, components, or systems for commercial, industrial, military, or scientific use. Exclude "Computer Hardware Engineers" (17-2061).
- 17-2072 Electronics engineers, except computer
Research, design, develop, and test electronic components and systems for commercial, industrial, military, or scientific use utilizing knowledge of electronic theory and materials properties. Design electronic circuits and components for use in fields such as telecommunications, aerospace guidance and propulsion control, acoustics, or instruments and controls. Exclude "Computer Hardware Engineers" (17-2061).
- 17-3023 Electrical and electronic engineering technicians
Apply electrical and electronic theory and related knowledge, usually under the direction of engineering staff, to design, build, repair, calibrate, and modify electrical components, circuitry, controls, and machinery for subsequent evaluation and use by engineering staff in making engineering design decisions. Exclude "Broadcast Technicians" (27-4012).
- 25-1021 Computer Science Teachers, Postsecondary
Teach courses in computer science. May specialize in a field of computer science, such as the design and function of computers or operations and research analysis. Include both teachers primarily engaged in teaching and those who do a combination of both teaching and research.

Appendix C

Methodology for Wage Data from PA Department of Labor and Industry

TECHNICAL NOTES

SURVEY METHODOLOGY

The OES survey, conducted in cooperation with the USDOL Bureau of Labor Statistics, is an annual mail survey of approximately 17,000 randomly selected Pennsylvania employers designed to collect fourth quarter employment and wage data for up to approximately 800 occupations.

Types of Businesses Included in the Survey

The scope of the survey includes establishments in: agricultural services; mining; construction; manufacturing; transportation & public utilities; wholesale and retail trade; finance, insurance, & real estate; and government.

Sample Stratification

The sample of employers is stratified by area, industry, and size class.

Workers Included and Excluded in the Survey

Workers or employees included in the OES survey:

- Workers who can be classified as full-time or part-time employees

- Workers on paid vacations or other types of leave

- Workers on unpaid or short-term absences

- Salaried officers

- Executives

- Staff members of incorporated firms

- Employees temporarily assigned to other units

- Employees for whom the reporting unit is their permanent duty station regardless of whether that unit prepares their paycheck

Workers or employees excluded from the OES survey:

- The self-employed

- Owners/partners of unincorporated firms

- Unpaid family workers

Wage Collection

Wages for the OES survey are straight-time gross pay, exclusive of premium pay and benefits.

Included Wages

- Base Rate

- Guaranteed Pay

- Hazardous-Duty Pay

- Longevity Pay

- Piece Rate

- Portal-to-Portal Rate

- Cost-of-Living Allowances

- Incentive Pay Including Commissions and Production Bonuses

- On-Call Pay

- Tips

- Deadheading Pay

Excluded Wages

Attendance Bonus
Draw
Holiday Premium Pay
Jury Duty Pay
Lodging Payments
Meal Payments
Merchandise Discounts
Nonproduction Bonus
Overtime Pay
Perquisites
Profit Sharing Plan
Relocation Allowance
Tuition Repayments
Uniform Allowance
Severance Pay
Shift Differential
Stock Bonuses
Tool Allowance
Vacation Pay
Weekend Pay
Back Pay

Source:

Pennsylvania Department of Labor and Industry
Center for Workforce Information and Analysis
Pennsylvania Occupational Wages
Winter 2002 – 2003 Edition 6.
<http://www.dli.state.pa.us/landi/lib/landi/cwia/occupwages/tech.pdf>

Appendix D

Methodology for State Long-Term Employment Occupational Projections

Source: <http://www.dli.state.pa.us/landi/cwp/view.asp?a=140&q=200854>

Data supporting industry and occupational projections were derived from the Occupational Employment Statistics (OES), Current Employment Statistics (CES), and ES-202 programs, which are cooperative efforts between the Pennsylvania Department of Labor & Industry and the U.S. Bureau of Labor Statistics.

OES Surveys

OES mail surveys – with telephone follow-ups to key respondents – are conducted on a three-year cycle. This allows for distribution of the intensive efforts involved in collecting, summarizing, analyzing, and accumulating data for all industries and occupations.

Samples of employers are chosen from the ES-202 files of employers covered by the state unemployment compensation law. Employers are classified using the Standard Industrial Classification (SIC) Manual of the U.S. Department of Labor. Occupations are grouped into 23 major groups, based on the U.S. Department of Labor's Standard Occupational Classification (SOC) coding structure.

Industry Projections

The first step in the industry projections process is the assembly of a historical series of annual average employment figures from the CES survey for total nonagricultural wage and salary employment at the three-digit SIC code level. County level data are then summed together into substate regions such as Metropolitan Statistical Areas (MSA) and Workforce Investment Areas (WIA). For each three-digit SIC, industry projections to 2010 were produced statewide and for each MSA and WIA.

Industry employment trends were obtained through multiple regression analysis, with consideration of several economic and demographic factors. This method measures the relationship between employment and one or more variables, such as population, labor force participation rate, unemployment rate, and CES-based industry employment trends. Time (years) and national employment were the independent variables.

Occupational Projections

Industries and occupations are merged using the industry-occupational matrix, which shows the occupational pattern of each industry. Occupational estimates resulting from the 1998, 1999, and 2000 OES survey cycle were used to generate the industry-occupational matrix for the base year 2000. Occupational patterns for industries outside the scope of the surveys (including agriculture, federal government, postal, private household, religious organizations, self-employed, and unpaid family workers) were developed using national OES statistics, Census data, Current Population Survey data, and state staffing patterns for federal government and postal workers.

Occupational ratios for each industry (three-digit SICs) were applied to the base and projected year industry employment totals. The projected year data has been adjusted for occupational changes over the projected period based on national change factors, which show whether the current trend in a particular occupation has its share of an industry growing or declining.

Job Openings

Job openings result when new positions are created by industrial expansion (growth) or when existing positions are vacated because of death, retirement, disability, or withdrawal for personal reasons (replacements). Vacancies created by promotion or transfers are not included in total job openings since there is no overall aggregate change in job availability. Total job openings equal the sum of growth needs

and replacement needs, except for cases when negative growth is greater than replacement needs, where total openings are expressed as zero.

Openings due to growth needs are the annual average change in employment for the projected period. Openings due to replacement needs are based on separation rates by occupation, which are derived from employment data gathered from the U.S. Department of Labor's Current Population Survey. The resulting separation rate is applied to the base-year employment in that occupation to produce average annual separations. Statewide rates are also used in estimating replacement needs for substate areas.

Data Limitations

This information is best used as an indicator of employment levels and trends, not as an exact count or prediction. These labor market projections should be used in conjunction with the users' knowledge of the state and local economy, and current events that may have an impact on the projections.

No distinction is made between full-time and part-time jobs. Since these estimates reflect the number of jobs rather than persons, the secondary jobs of multiple jobholders are included.

In preparing these projections, the following assumptions were made:

- The historical industry employment data are correct, i.e., industries are properly classified, counted in the correct geographical area, etc.
- No dramatic changes will occur in any specific industry between 2000 and 2010.
- The industry staffing patterns obtained by the OES survey are accurate and projected changes are reasonable.
- The staffing patterns, change factors, and separation rates applied to the data are valid for Pennsylvania.
- The Pennsylvania economy and population will continue to grow, reflecting past trends, without major external factors.
- The effect of current technology and scientific trends on industrial employment will continue.

Every effort was made to ensure the reasonableness of the data. Accuracy of the data is subject to both sampling and nonsampling errors. Nonsampling errors – despite efforts to minimize them – may occur from nonresponse, errors in response such as a misunderstanding of instructions or occupational definitions, and errors in survey editing, coding, or tabulation. Sampling errors, usually measurable as relative errors or estimates, are inherent in surveys that do not include entire populations.



The purpose of Penn State-Erie's **Economic Research Institute of Erie (ERIE)** is to collect, analyze, interpret and disseminate data and information on the Erie regional (Erie County) economy. Another important goal of ERIE is to provide our undergraduate and graduate students with relevant experience with applied economic research and data analysis. Established in late 1982, the Institute is an applied research unit of Penn State-Erie's Black School of Business.

We do not wish to duplicate the activities of other Erie-area organizations. Rather, we seek to use our collective training and experience in the areas of data manipulation and technical analysis to provide support to those whose expertise falls in different fields.

ERIE's continuing research program helps the local community better understand the regional economy and its linkages to the national economy. ERIE provides a source of information for local leaders and media who have questions about the local, national and international economies. ERIE compiles data on the local economy from a range of sources, and helps local users access and evaluate these data.

Some of the studies that ERIE has undertaken include:

- an estimate of the impact of a 1% additional sales tax for Erie County Regional Assets and property tax reform;
- estimates of productivity of Erie's workers through time and across industries, compared to the nation;
- estimates of brain drain and brain gain for Penn State graduates, from Erie County;
- creation of a model to forecast total Erie employment, as well as employment in durables and nondurables manufacturing, total manufacturing, and non-manufacturing industries;
- three studies of philanthropic giving in the Erie area; and
- a model to estimate the cost of living in all 67 counties of Pennsylvania for a state government agency.

With the support of the Erie Regional Chamber and Growth Partnership, ERIE has created www.ERIEdata.org, a free website with hundreds of thousands of data points for the Erie and national economies, along with copies of ERIE and other research reports on the local economy, all easily available for free downloading.

ERIE staff have made numerous presentations in the local community, speaking to audiences at the Manufacturer's Association of Northwest Pennsylvania, the Erie Community Foundation, the Erie Chapter of the National Association of Purchasing Management, the Erie Conference on Community Development, the Erie Ambassadors, and all eleven Leadership Erie classes, among others. ERIE regularly provides information for the print and electronic media in the community. In addition, ERIE's work has resulted in an enhanced awareness of the Erie regional economy among national and international audiences. This stems from the nearly 90 technical paper presentations made by Institute staff members at national and international conferences and over 30 articles in refereed professional journals. And more than three dozen students have had the chance to do meaningful research with ERIE, often with funding from contracts and grants.

We would be happy to discuss potential projects with members of the Erie community, and welcome all to attend our annual economic conference. Contact Dr. Kurre at k12@psu.edu or (814) 898-6266 for more information or to sign up for ERIE's electronic newsletter.