

**Opportunities for Growing the  
Information Technology Cluster  
in Pennsylvania**

**Submitted to the Ben Franklin  
Technology Center of Western  
Pennsylvania**

**Prepared by the  
Center for Economic Development  
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## **Executive Summary**

In 1997, Governor Ridge and the Ben Franklin/IRC Partnership Board initiated Technology 21, a strategic planning process to promote the development of the state's technology base. The Board commissioned the Battelle Memorial Institute in 1998 to benchmark the Partnership against leading technology programs and develop an action plan for the Partnership to implement the Technology 21 strategy. The board also charged each Ben Franklin Technology Center with the task of developing competitiveness strategies for each technology cluster.

The Ben Franklin Technology Center of Western Pennsylvania (BFTC/WP) was appointed the lead center for the Information Technology (IT) Cluster. The BFTC/WP contracted the Center for Economic Development at Carnegie Mellon University (CED) to conduct the analysis of the cluster. The CED's analytical capabilities and its experience in the first phase of the Technology 21 process offered expert knowledge and resources for the data analysis and focus group discussions that are the core of this report and its recommendations.

The CED analyzed a variety of data on the performance and scope of the IT cluster in Pennsylvania. This analysis is presented in the section on Growth Trends and some Key Facts are summarized below. The notes on the data sources and methods can be found in Appendix 2. The CED also conducted focus group sessions with industry representatives for the cluster in each Ben Franklin region. In some cases, the focus group sessions were supplemented by targeted surveys to verify information gleaned from the focus group participants. The goal of these sessions was to get statewide representation of the cluster and to identify common areas that pertain to the cluster. The regional differences were found to be minimal in terms of the needs of the companies or different strategies to support the cluster in that region. The section, Regional Highlights on page 14, reviews the regional differences.

### ***Key Facts***

- In 1995 Pennsylvania ranked 8<sup>th</sup> in IT employment and 7<sup>th</sup> IT establishments.
- The IT Cluster is concentrated in the Southeastern and Western regions of the state.
- The highest growth rate in employment for the IT cluster occurred in Western PA (29%), while the greatest increase in establishments occurred in the South-Central region (70%). The Northeastern region produced the largest growth in payroll (50%).
- Pennsylvania universities provide significant resources and expertise for the IT cluster and account for 9% of the total University R&D expenditures in the United States for Math and Computer Sciences.

## **Summary of Opportunities**

In developing recommendations for the Information Technology cluster we have made every effort to provide consistency with previous work on Technology 21, as well as the strategy developed by Battelle. In order to make those connections clear, we have provided a chart of the Battelle recommendations (See Appendix 1: Summary of Battelle Recommendations) that is linked to our recommended priorities for the IT cluster, summarized in Table 1: Opportunities for the IT Cluster. These tables can be cross-referenced using the codes in bold type in the Battelle recommendation in Appendix 1 that correspond to the cells in Table 1.

The Battelle report recommended eight key strategies for growing Pennsylvania's technology-based economy. These strategies are incorporated in the opportunities for the Information Technology cluster identified in this report. The strategies are:

- Establish new partnerships, and strengthen existing partnerships with PA's universities and colleges.
- Attract increased federal research and development funding.
- Continue to invest, in partnership with the private sector, in new and expanding technology-based businesses.
- Improve PA's entrepreneurial culture and support for new and existing technology-based companies.
- Support the growth of industry clusters in key technology sectors.
- Assist the commonwealth in ensuring that PA has knowledge workers demanded by technology-intensive industries over the coming decade.
- Serve as a key advocate for technology-based companies, both large and small.
- Increase understanding in the marketplace, both inside and outside of PA, of the high tech capabilities of the state's workforce, support industries, education and training institutions.

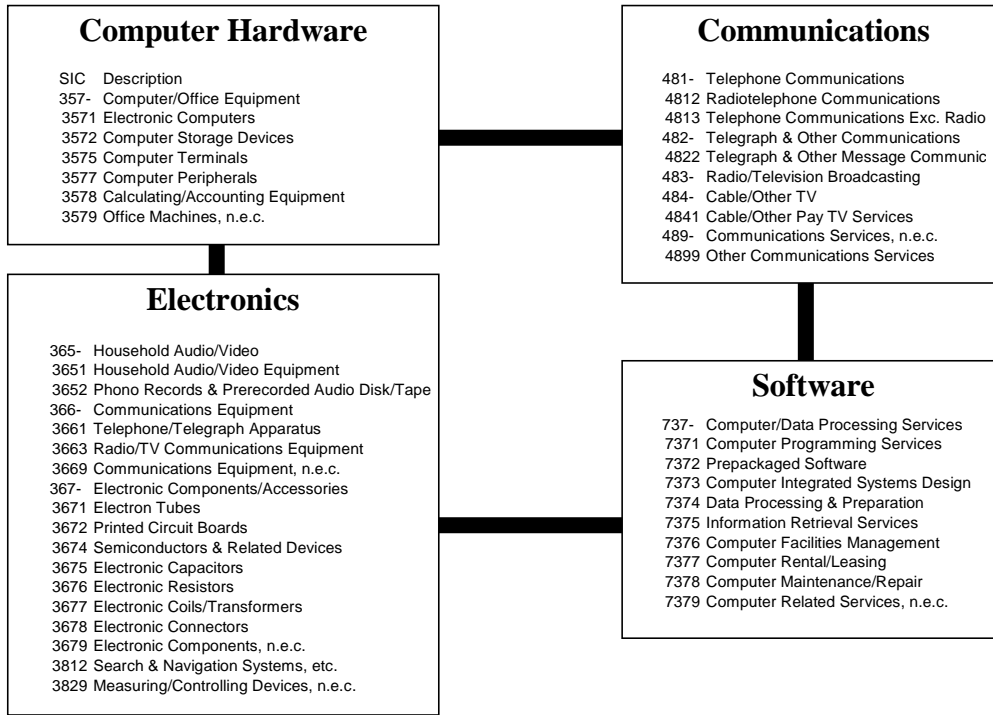
**Table 1: Opportunities for the IT Cluster**

<b>Goals</b>	<b>Strategies</b>	<b>Opportunities</b>
<b>1 - Develop the Technology Infrastructure</b>	<p>A. Increase access to risk capital and growth financing</p> <p>B. Increase the critical mass of IT firms</p> <p>C. Assist technology-intensive industries to recruit and train knowledge workers</p> <p>D. Support efforts to expand the state's strengths in IT-related R&amp;D</p>	<ul style="list-style-type: none"> <li>• Establish the Technology 21 Seed Capital program providing larger multi-year investments to selective firms</li> <li>• Promote access to private venture capital and angel investments</li> <li>• Streamline the process of business incorporation</li> <li>• Discourage computer services tax</li> <li>• Provide scholarships and incentives for PA-trained talent to work in PA firms</li> <li>• Eliminate barriers to recruiting talent</li> <li>• Consult with industry on workforce needs</li> <li>• Promote industry input to university research agendas and curriculum</li> <li>• Promote access to university resources and intellectual property</li> <li>• Work with the Commonwealth to create a Strategic Technology Investment Fund</li> </ul>
<b>2 - Promote Innovation and Entrepreneurship</b>	<p>A. Support the growth of industry clusters in key technology sectors</p> <p>B. Improve PA's entrepreneurial culture and support for new and existing technology-based companies</p>	<ul style="list-style-type: none"> <li>• Encourage responsiveness to industry timeframes</li> <li>• Align funding with industry needs</li> <li>• Provide in-depth commercialization mentoring and assistance</li> <li>• Facilitate the formation of industry associations and networks</li> </ul>
<b>3 - Provide Leadership on Technology Issues</b>	<p>A. Serve as a key advocate for technology-based companies, both large and small.</p> <p>B. Increase understanding both inside and outside of PA of the high tech capabilities of the state's IT Cluster</p>	<ul style="list-style-type: none"> <li>• Explore changes in state programs to accommodate the needs of IT firms</li> <li>• Support creation of an industry led science and technology advocacy group at the state level</li> <li>• Promote the high-tech image of the state, connecting other marketing efforts with technology promotion</li> <li>• Develop a system for benchmarking regional and state performance</li> </ul>

*Note: This chart is adapted from the recommendations in the Battelle report, September 1998.*

## Growth Trends

**Figure 1: Components of the IT Cluster**



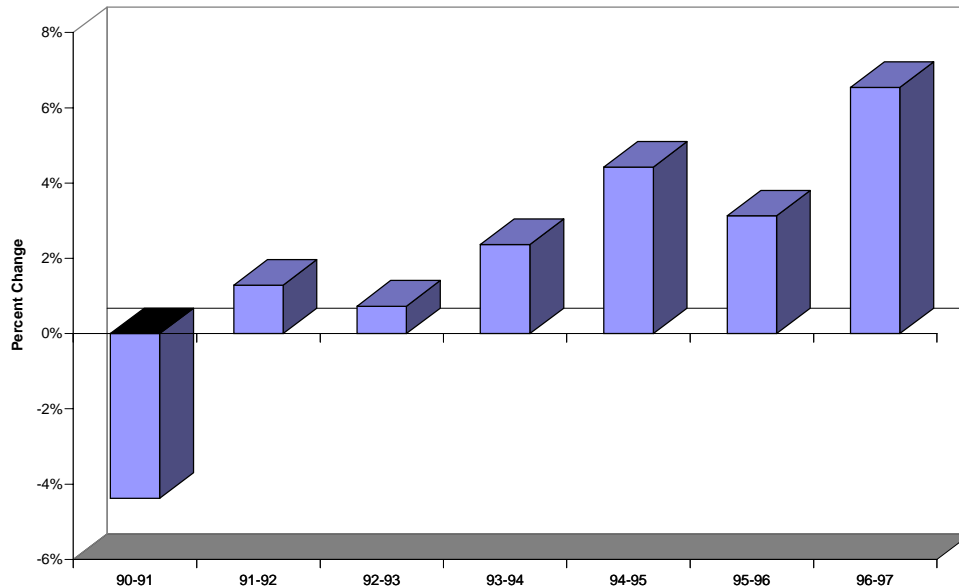
This section examines the trends in the cluster and its components. According to data from the Pennsylvania Department of Labor and Industry, there are over 5,600 firms in the cluster providing \$7.2 Billion in wages and nearly 152,000 jobs. Figure 1 presents the definition of the Information Technology Cluster that was used for this report. Table 2 presents the employment and changes in the cluster. The most positive sign in this data is that the largest components of the cluster generated significant growth. Figure 2 demonstrates that the bulk of the employment growth in the IT cluster has occurred since 1994.

**Table 2: Employment Growth by Sub-Clusters**

<i>Sub-Cluster</i>	<i>1990</i>	<i>1997</i>	<i>Change</i>	<i>Percent Change</i>
Communications	47,027	52,805	5,778	12%
Computer Hardware	9,922	8,114	-1,808	-18%
Electronics	41,895	42,319	424	1%
Software	32,536	48,698	16,162	50%
Grand Total	131,380	151,936	20,556	16%

*Source: PA Department of Labor and Industry, ES202 database.*

**Figure 2: Annual Employment Change, 1990-1997**



*Source: Pennsylvania Department of Labor and Industry, ES-202 database.*

### **Benchmarks**

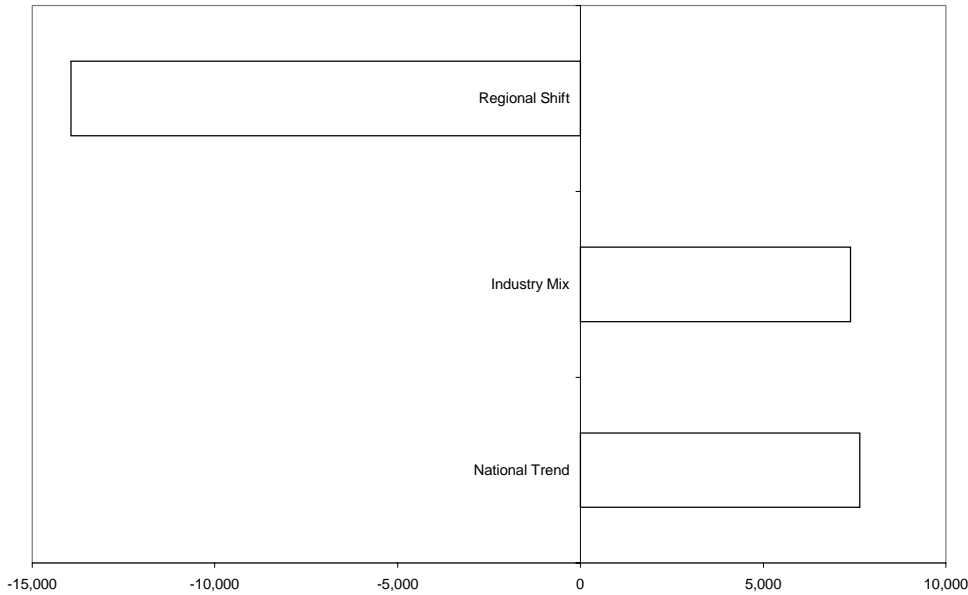
This section places Pennsylvania in a comparative perspective to the rest of the nation. The data in this section is drawn from County Business Patterns and due to differences in data collection, counting and confidentiality procedures this data may not be comparable to the ES202 data.

Information Technology is a national and statewide growth sector, but not all sectors of the cluster are growing. Between 1990 and 1995, the annual growth rates in Pennsylvania lagged the average growth for IT in the nation which was just over five percent. Shift-share analysis enables us to examine the proportions of growth or decline that is attributable to overall national trends, problems of industrial specialization, or factors of regional competitiveness.

The shift-share analysis for the IT cluster indicates that given overall growth in the national economy, as well as the composition of the state's IT cluster, Pennsylvania should have had more growth in the cluster (See Figure 3). The positive industry mix indicates that the state specialized in sectors that grew more than it did in the declining sectors. The shift-share analysis also demonstrates that regional factors depressed growth in the IT cluster. There is very little that the state can do to affect national economic growth and it required more than a decade to diversify the composition of industry, but the state, does have the ability to eliminate barriers to competitiveness. Shift-share analysis does not identify those barriers, but the focus group sessions held throughout the

state identified several of the key barriers. These barriers include the challenge of recruiting technically skilled talent, the lack of risk capital, the dispersion of IT around the state, and inadequate coordination of state programs and activities.

**Figure 3: Change in IT Employment, 1990-1995**



*Source: County Business Patterns*

**Table 3: Average Wages, 1995**

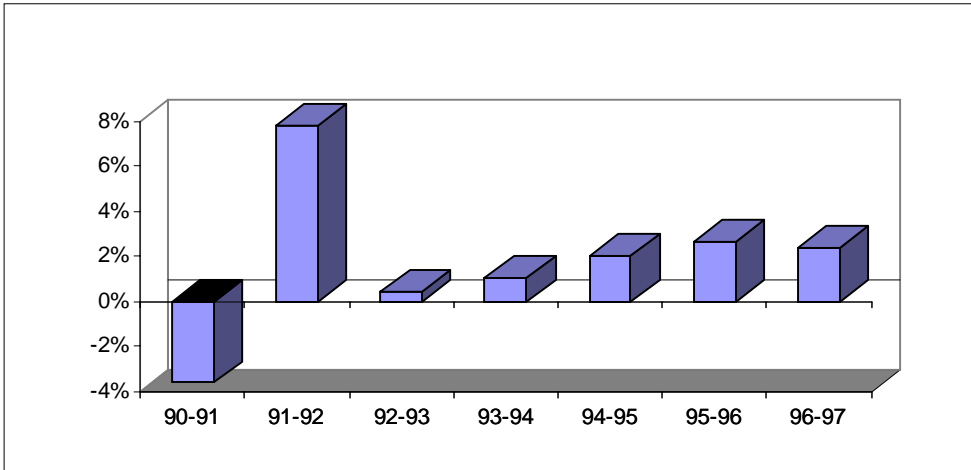
	<i>IT Cluster</i>	<i>All Industries</i>
United States	\$ 45,995	\$ 27,988
Pennsylvania	\$ 42,966	\$ 27,659

*Source: County Business Patterns*

In both the state and the nation, wages in the IT cluster are more than 150% of the average wages in all other industries. In Pennsylvania alone, wages in the IT cluster average 120% more than the wages in the state’s other technology sectors. However, while Pennsylvania is commonly regarded as a high wage state, the average wages in the IT industry are just over ninety percent of the average IT wages in the US. Wages in the cluster rebounded in 1992 from a steep decline in 1991. Since 1992 wages in the cluster have reached a stable annual growth rate of about two percent (See Figure 4). All of the wage data has been inflation adjusted to 1997 values. According to the focus groups, Pennsylvania’s low cost of living is a key factor in keeping the wage costs low for the cluster. Conversely, these lower wages can make it more difficult to attract talent.



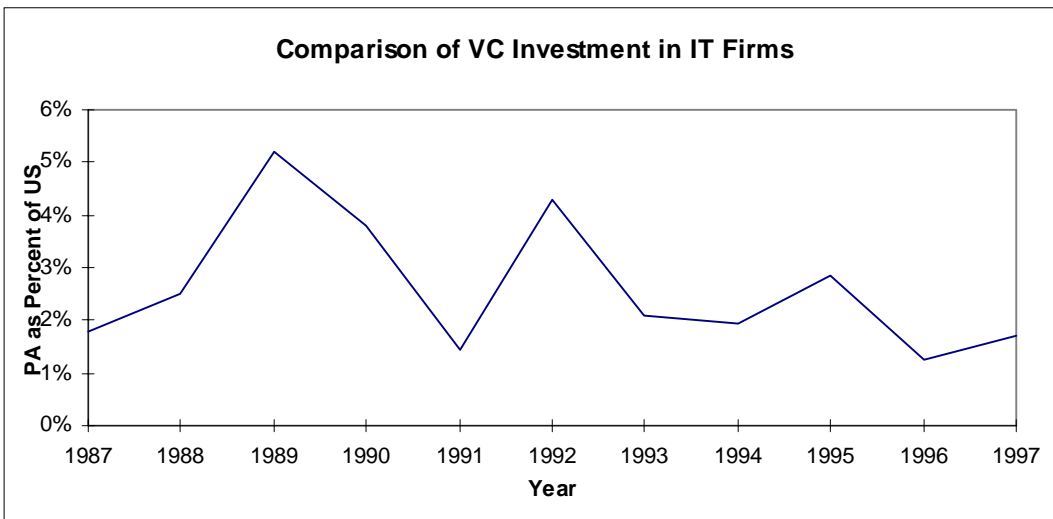
**Figure 4: Annual Wage Growth, 1990 - 1997**



Source: PA Department of Labor and Industry.

The availability of growth capital is a critical issue to Pennsylvania's entrepreneurial firms. Venture Capitalists invested just over \$280 million in the state between 1987 and 1997. Venture capital has been relatively scarce in the state since 1990 – Pennsylvania has accounted for only three percent of the venture capital invested annually in the United States during that time (See Figure 5). Venture capital for early stage firms has been particularly scarce.

**Figure 5: PA's Share of Venture Investment**

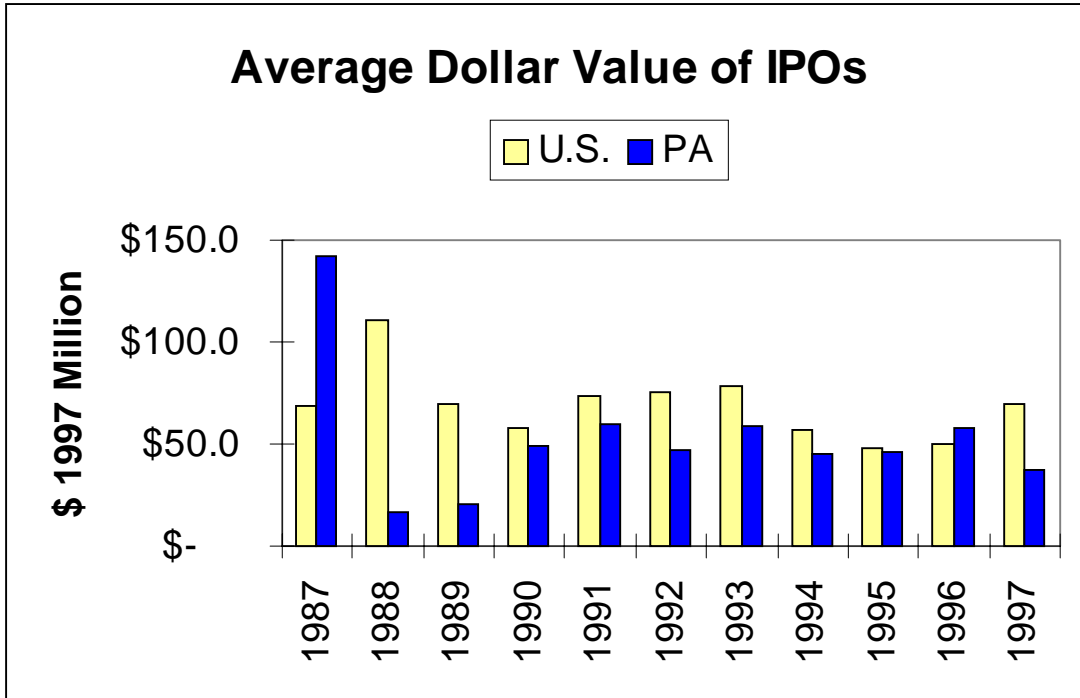


Source: Venture Economics, 1997

Pennsylvania has also performed below expectations in the area of initial public offerings (IPOs). Only three percent of IPO issues, and two percent of IPO proceeds are generated by Pennsylvania companies. Furthermore, the average dollar value of an IPO in Pennsylvania has been below the US average except in 1987 and 1996 (See Figure 6). Pennsylvania has fewer companies in the capital markets and they raise less money. In

part this lack of capital reflects the lack of investment opportunities in the state. Pennsylvania has an average rate of business incorporation that is approximately one-half of the national rate (1.46 per 1,000 persons vs. 2.80 per 1,000 persons.)<sup>1</sup>

**Figure 6: Value of IPOs**



Source: Securities Data Corporation, 1997.

<sup>1</sup> Incorporation data for Pennsylvania and the U.S. was provided by Securities Data Corporation.

## **Opportunities**

### **1. Technology Infrastructure**

#### **A. Increase access to risk capital and growth financing**

Firms in the state's IT cluster have had difficulty raising angel and venture capital. The problem is not a lack of venture money in the state, but rather that a technology firm is considered too risky by the state's investment community. Many felt that it was easier to raise money on the West Coast, where the investors made their money in high tech firms. In fact, several firms had raised money from West Coast sources.

Choosing an investment partner is critical to the success of the company and requires an investor familiar with technology and the specific industry who can bring the company out in a strong position at the right time. The group recommended against government programs to refer companies to venture investors, claiming that these investors were not receptive to these referrals. The participants expressed a need for a network of people who have been successful raising angel and venture money, as well as help to identify the right investment partners.

Access to technology-savvy capital is the critical problem. The entrepreneurs recommended that any new efforts to provide state or BFTC-seeded venture funds should acknowledge the risks of the venture and provide sufficient funds for meaningful investments. The Ben Franklin program was also encouraged to the size of Ben Franklin awards (See Opportunity 2A below). Currently the awards are too small to enable IT firms to get their product to market quickly and to demonstrate the viability of their company and their technology to potential private investors. Larger investments would enable these firms to prove their technology, and with the potential for a matching commitment from a state seed capital fund they should be able to attract more money from private investors. The participants suggested that the state could direct money into a co-funding arrangement as a committed part of a syndicate, taking a second position behind a major investor.

### **Opportunities**

- Establish the Technology 21 Seed Capital program providing larger multi-year investments to selective firms, as recommended by the Battelle Memorial Institute.
- Promote access to private venture capital and angel investments.

### **Key Players**

Governor, General Assembly, DECD, BF/IRC Board, BFTCs.

## B. Increase the critical mass of IT firms

Table 4 presents the relative sizes of the state and national economies for all industries and the IT cluster. In general, Pennsylvania holds a lower share of the IT Cluster than is expected given the size of Pennsylvania's overall economy. PA accounts for 4.7% of the nation's employment, but only 3.7% of the IT employment. The good news is that we are less specialized than the rest of the nation in the IT cluster and there is the potential for future growth in the IT cluster within PA. Pennsylvania, with less than four percent of the nation's IT firms, needs to increase the critical mass of IT firms. According to data from the Pennsylvania Department of Labor and Industry, the IT cluster has demonstrated strong growth in the state. Between 1990 and 1997, employment increased by fifteen percent and the number of firms increased by sixty-six percent. The 1997 payroll of \$7.2 billion for the cluster represent an increase over the 1990 payroll of nearly sixty percent, or thirty percent when adjusting for inflation. The average growth in employment and payroll since 1990 is only two percent due to the early 1990s recession. Most of the gains in the IT cluster have come since 1995 and primarily 1997, when the annual growth rates in employment reached seven percent (See Growth Trends on page 1). This data indicates the clusters vulnerability to economic downturns and that the state must work to maintain the high levels of growth posted in 1997.

**Table 4: Pennsylvania's Share of U.S. Industry, 1995**

<i>Share of US Industry</i>	<i>Employment</i>	<i>Payroll</i>	<i>Establishments</i>
All Industries	4.7%	4.6%	4.3%
Information Technology	3.7%	3.4%	3.7%

*Source: County Business Patterns*

The focus group participants echoed the lack of critical mass, but could not agree on solutions. A larger base of IT firms will increase the potential for innovative ventures between firms and improve recruiting efforts by providing more opportunities for IT employees. The focus groups were split on the value of attracting magnet companies to the state as a way to grow a critical mass of IT firms. There was consensus that Pennsylvania remains a difficult state in which to operate. Most participants started their business in Pennsylvania as a result of family ties. Despite some streamlining, the process of business incorporation in the state is still complex, and it is difficult to find competent advice. There was also consensus that computer services taxes should be discouraged because such taxes would inhibit new business development in the IT cluster. In addition, some entrepreneurs described how the Department of Revenue issued conflicting instructions regarding whether and how to apply the tax to their business. The most effective route to increasing the critical mass of IT firms would be to improve access to risk capital and make it simpler, faster, and cheaper to start and operate a business.

## **Opportunities**

- Streamline the process of business incorporation.
- Discourage the computer services tax.

## **Key Players**

Governor, Department of State, Department of Revenue, DCED, BFTCs

### **C. Assist technology-intensive industries to recruit and train knowledge workers**

The Information Technology cluster is confronted by a workforce challenge that is a recruiting and not an education problem. In order to ensure that our educational system continues to produce a technically skilled workforce, industry should be consulted on curriculum development and their education needs. Currently, the state's universities produce a sufficient quantity and quality of talent, but it is not retained. Firms also have difficulty recruiting talent from other areas. The reasons for this difficulty are the lack of critical mass, which reduces employment opportunities, and an out-dated perception of Pennsylvania regarding technology and quality of life. The IT cluster is a rapidly changing field and it is likely that the education system will not be able to respond quickly enough to changes in the demand for different skills. The state should eliminate barriers to recruiting talent, such as limits on H1-B visas that enable IT firms to quickly respond to the need for new skills. Training programs that can quickly produce talent with the required skills would also be useful, but they would have to turn out qualified candidates in weeks or months, not years.

State-supported incentives such as scholarships that link student to internships in technology firms would provide a way to help retain the talent that is educated in Pennsylvania. The scholarships could be in the form of direct subsidies for tuition or loan forgiveness programs for graduates employed in an IT firm. These programs could also link with a first-time homebuyers program to help these knowledge workers establish roots. The participants widely agreed that while Pennsylvania is not viewed favorably by young professionals looking for excitement, it does have a lot to offer young families. Pennsylvania should also recognize the trend towards two-income families and sponsor a program that offers employment placement assistance to the spouses of potential technology recruits. The participants also agreed that "boomerangs" - individuals who were educated or raised in Pennsylvania, but left at the start of their career - are the best targets for recruiting. These programs should support the return of these "boomerangs".

## **Opportunities**

- Provide scholarships and incentives for PA-trained talent to work in PA firms.
- Eliminate barriers to recruiting talent.
- Consult with industry on workforce needs.

## Key Players

DCED, BF/IRC Board, BFTCs, Department of Education, Universities, and Industry Associations

### D. Support efforts to expand the state's strengths in IT-related R&D

Pennsylvania accounts for 9% of the total University R&D expenditures in Math and Computer Sciences.<sup>2</sup> These fields account for over 7% of the University R&D expenditures in the state of Pennsylvania. Pennsylvania has held a stable 8% of these R&D expenditures from 1993-1996. Over this period, expenditures in Math and Computer Science R&D grew 7% in the state, compared to 4% for the rest of the nation. Pennsylvania universities are ranked relatively high in expenditures for research and development in information technology fields. Table 5 presents the rank of the Pennsylvania universities in the top 100 for Computer Science and Math research and development expenditures.

**Table 5: Rank in R&D Expenditures**

<i>University</i>	<i>Computer Science</i>	<i>Math</i>
Carnegie Mellon University	2	21
University of Pennsylvania	26	54
Pennsylvania State University	35	31
University of Pittsburgh	73	86
Drexel University	91	Not Ranked

*Source: National Science Foundation*

The state should take steps to maintain and expand the pre-commercial research base. This could be accomplished through a matching fund to attract research activity and funding to universities and industry consortia. These efforts should be focused on technologies that can be commercialized in the state and that support growth in Pennsylvania industries. Incentives must be incorporated into any programs or funding that requires and rewards industry participation and input. These efforts must also provide an efficient mechanism for industry to access and commercialize the intellectual property developed through these efforts and to realize industry time to market goals.

## Opportunities

- Promote industry input to university research agendas and curriculum.
- Promote access to university resources and intellectual property.

<sup>2</sup> Source: NSF, Academic R&D Expenditures, FY 1996, Tables B-23, B-31, B-56, B-57.

- Work with the Commonwealth to create a Strategic Technology Investment Fund, as recommended by the Battelle Memorial Institute.

### **Key Players**

Industry Associations, Universities, BFTCs, Governor, General Assembly, BF/IRC Board, DCED

## **2. Innovation and Entrepreneurship**

### **A. Support the growth of industry clusters in key technology sectors**

The Ben Franklin program has been a national model for fostering innovation and entrepreneurship in technology industries. However the program itself needs to adapt continuously to changing industry conditions and needs in order to get the maximum value from the state's investment and the maximum benefit from the state's technology base. Industry representatives expressed broad support for increasing the size of the investments even if it would reduce the number of companies funded. The real value of the Ben Franklin awards have been eroded by inflation so that the investments provided today buy less than those awarded in the early years of the programs. Increasing the investment level to \$150,000 to \$250,000 per year would provide the purchasing power of \$100,000 to \$150,000 when the program was founded. One participant complained that the current amounts are not sufficient to pay for one software development person when you factor in the cost to recruit and equip that person. The award limits and award amounts should be related to the financial requirements of the company and their proposed project.

The award process should also be more sensitive to the timing issues of getting technology to market. Currently entrepreneurs have to adapt to the programs award cycles even if those cycles might increase their time to market. The Ben Franklin program should focus on reducing the award cycle or allow investments to roll-over funding years. The implementation of these changes would most likely require the program to provide an effective mechanism for the centers to roll-over or reserve unspent Challenge Grant funds from the state, rather than the current system which requires the return of these funds to the state.

### **Opportunities**

- Encourage responsiveness to industry timeframes.
- Align funding with industry needs.

### **Key Players**

BFTCs, BF/IRC Board, Industry Associations

## B. Improve PA's entrepreneurial culture and support for new and existing technology-based companies

The Ben Franklin program should continue to maintain a balance between support for technology and commercialization issues. Mentoring services should be organized to supply help on a variety of business and commercialization issues, as well as access to technology-savvy investment, access to university resources and networking and coordination. Given the variety of experience and expertise between the centers, there was no clear consensus on a best model to provide mentoring. However it is clear that the BFTCs must be careful to maintain their focus on services related to technology and entrepreneurs and to provide or facilitate technology relevant services where gaps exist. Many participants suggested that the centers engage in more cross-fertilization and benchmarking of activities in different regions so that best practices in mentoring can be shared.

There is a need to bring focus to the state's economic development resources. The state has aggregate strength as a technology economy, but it is dispersed into several disconnected nodes. Networking can help to bridge these gaps which occur mostly in the Central and Northern and Northeastern Tier regions. Philadelphia and Pittsburgh have some networking infrastructure for CEOs, CFOs and CTOs, but there is a lack of peer networks for critical talent, such as software developers. In general, the IT firms preferred informal and more personal forums for networking as opposed to large, formal events or electronic forums. The BFTCs were praised for the value that they offered as a latent network, but there was mixed support for a more formal role for the centers. Where existing networks are in place, the BFTCs should support rather than duplicate their efforts. Where no networks exist, the BFTCs can help to connect clients to existing networks and associations, and support informal gatherings where entrepreneurs can discuss issues of mutual interest.

### **Opportunities**

- Provide in-depth commercialization mentoring and assistance.
- Facilitate the formation of industry associations and networks.

### **Key Players**

Technology Councils, Industry Associations, BFTCs



### **3. Leadership in Technology Issues**

A. Serve as a key advocate for technology-based companies, both large and small.

Pennsylvania enjoys the advantage of a large and experienced economic development infrastructure. This economic development infrastructure helped the state's economy to diversify and recover from the collapse of the state's traditional industries. That same infrastructure, however, is now out of step with the new industries that will drive growth in the future. It is time for these new firms to help the state to adapt to the realities of the new economy. This is the central idea of the Technology 21 process. The Ben Franklin Partnership is the state's premier technology program, and is nationally recognized as a model program. It is thus a natural role for the Ben Franklin program to exercise leadership in this regard.

Currently many of the requirements and incentives in the state's loan and financing program discourage or disqualify technology firms. Requirements that focus only on the number and not the quality of jobs can make technology firms virtually ineligible to receive funds. Furthermore, programs that provide for equipment purchase often contain depreciation schedules or other requirements that do not match expected lifetimes for equipment in many technology applications. A BFTC sponsored task force that builds on the participation initiated in the Technology 21 process should work with the Department of Community and Economic Development to review programs for requirements that inhibit the participation or success of technology firms.

Currently requirements are developed to meet administrative needs and not the needs of companies. This is understandable to a degree, but when the programs are not making companies successful then they should be changed or eliminated. Programs should be able to provide support to companies with growth potential and not merely provide bailouts to companies that are ultimately not competitive. One example is the degree to which the "speed of technology" is recognized both in the program requirements and by the staff. Currently the approval process of most programs is too slow to be of use to many technology firms. When technology applications have to make it to market in six to eighteen months, waiting three to six months for approval on financing reduces the chance that a company can get to market on time. Another element is that the financing amounts are often not flexible enough to meet the needs of the applicants. The minimum and maximum financing amounts are set by administrators and are not related to the financial needs of the firms. Ben Franklin can play a role in helping companies to justify their funding needs and time frames on complicated projects to loan or grant agents that may not understand a technology application.

The Technology 21 participants expressed a lot of hope that this process would generate real results and not just more reports. It is also apparent that they feel it is important to focus on the most critical needs first and not to tackle issues that can not be accomplished. One of the themes of the focus group meetings was the lack of understanding of technology issues among state leaders. The BFTCs can do much to

encourage support for technology firms and issues, but it cannot act as an industry lobbyist. Ultimately, the technology community itself must become more active and vocal in representing its interests to the state's leadership. An advocacy group of this nature would have to be industry-led and independent of the BFTCs.

### **Opportunities**

- Explore changes in state programs to accommodate the needs of IT firms.
- Support creation of an industry led science and technology advocacy group at the state level.

### **Key Players**

Governor, DCED, BF/IRC Board, BFTCs

## **B. Increase understanding both inside and outside of PA of the high tech capabilities of the state's IT Cluster**

The state's marketing and tourism strategies should be integrated with the promotion of its technology clusters. Currently there is too much focus on older industries and technology. Leveraging technology promotion into the state's existing marketing efforts provides a cost-effective strategy to increase awareness of the IT Cluster. This effort would be in the domain of the advocacy group described above. It will also be important to maintain current knowledge of the performance of the IT Cluster, as well as the programs and efforts designed to support.

The Technology 21 process has already deepened our understanding of the IT cluster, but given the dynamic nature of this cluster this effort must be ongoing. The network of IT firms activated by the Technology 21 process and the analysis of the cluster provides a good starting point for developing a benchmarking system. A benchmarking system should be able to provide timely and accurate intelligence for policymakers on the on the opportunities and vulnerabilities facing the state's IT Cluster. This benchmarking effort would require a partnership between the US Bureau of the Census, and the Pennsylvania Department of Labor and Industry.

### **Opportunities**

- Promote the high-tech image of the state, connecting other marketing efforts with technology promotion.
- Develop a system for benchmarking regional and state performance.

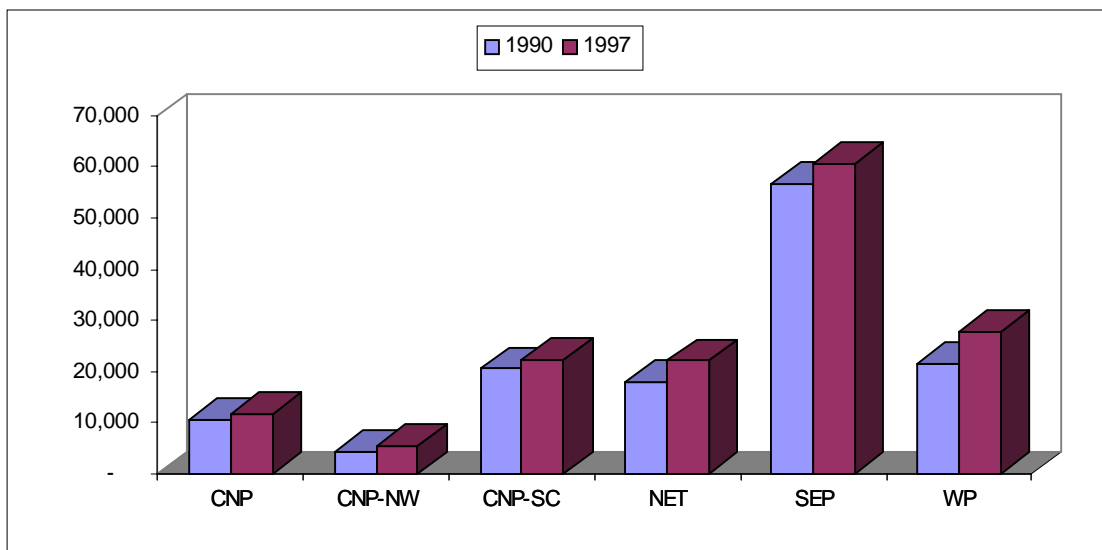
### **Key Players**

DCED, Department of Labor and Industry, Bureau of the Census, BF/IRC Board, Technology Councils, an independent research center

## Regional Highlights

Pennsylvania's IT firms are concentrated in Southeastern (SEP) and Southwestern Pennsylvania (WP). According to this data, the growth in employment has occurred in the western and central regions, with other areas of the state holding steady or showing small declines. Table 6 indicates that most of the state's growth in IT establishments occurred in the Southeast and West. The highest growth rate for IT employment occurred in Western PA. The Northeast and Northwest showed strong increases, but started with much smaller employment bases.

**Figure 7: Information Technology by Region, 1990-1997**



**Table 6: Change in Establishments, 1990-1997**

Region	1990	1997	Change	Percent Change	Share of State's Growth
CNP	306	376	70	23%	3%
CNP-NW	143	215	72	50%	3%
CNP-SC	403	687	284	70%	13%
NET	334	511	177	53%	8%
SEP	1,448	2,338	890	61%	40%
WP	653	983	330	51%	15%
Not-Disclosed	144	569	425	295%	19%
<b>TOTAL</b>	<b>3,431</b>	<b>5,679</b>	<b>2,248</b>	<b>66%</b>	<b>100%</b>

Source: PA Department of Labor and Industry, ES202 Database.

Note: The totals of regional data will not sum to the state due to non-disclosed data..

Table 7 presents an index of the concentration of sub-clusters employment for each region. This index expresses the amount of employment in each sub-clusters as a

proportion of IT employment in that region, compared with the statewide employment in that sub-clusters. Values above 1.0 indicate that the region is more concentrated than the rest of the state in that sub-clusters. The southeastern and western regions dominate the IT cluster in the state, but there may be important regional concentrations of sub-clusters that are obscured by the aggregate data. Of all of the sub-clusters, communications is the most evenly distributed in the state. Electronics is concentrated between the poles of Pittsburgh and Philadelphia, which dominate in both computer hardware and software.

**Table 7: Employment Concentration, 1997**

<i>Region</i>	<i>Communications</i>	<i>Electronics</i>	<i>Computer Hardware</i>	<i>Software</i>
CNP	1.17	1.68	-	0.49
CNP-NW	1.32	1.75	-	0.26
CNP-SC	0.97	1.42	0.14	0.86
NET	1.01	1.94	-	0.47
SEP	0.86	0.54	1.89	1.35
WP	1.20	0.51	1.13	1.12

*Source: PA Department of Labor and Industry, ES202 Database.*

The growth in the sub-clusters is very much a story of regional growth and decline (See Table 8). The statewide performance of the sub-clusters reflected their performance in the regions, especially Southeastern PA. The sub-clusters with the lowest statewide growth from 1990-1997, both declined in Southeastern PA and the sub-clusters with statewide growth also grew in the Southeastern region. Western Pennsylvania enjoyed growth across the board in every sub-cluster. Statewide, the performance of the cluster will be determined by the Southeastern and Western regions and by the Communications and Software sub-clusters. The support strategies devised for the IT cluster in each region should incorporate the important role that Electronics and Computer Hardware sub-clusters have played in some regions. In these regions, efforts to promote these sub-clusters should be integrated with efforts to improve manufacturing processes.

**Table 8: Employment Change, 1990-1997**

<i>Region</i>	<i>Communications</i>	<i>Electronics</i>	<i>Computer Hardware</i>	<i>Software</i>
CNP	15%	20%	-100%	-7%
CNP-NW	10%	53%	NA	-15%
CNP-SC	5%	-13%	-49%	70%
NET	13%	12%	-100%	91%
SEP	3%	-14%	-30%	46%
WP	15%	17%	27%	54%
TOTAL*	12%	1%	-18%	50%

*Source: PA Department of Labor and Industry, ES202 Database.*

*\*Note: The total reported here is derived from statewide for the sub-clusters.*

## **Central and Northern Region**

The Central and Northern region, due to its size, is divided into its satellite regions for this analysis.

### **CNP (State College)**

The Central and Northern region, centered around State College experienced a 23% increase in IT establishments, and grew by 12% in both employment and wages. Overall, this region of the state had the lowest growth for the cluster in the state.

IT related R&D expenditures in the universities accounted for just over 2% of the University-based R&D in the region in 1996. Math and Computer Sciences are not the specialty of the region's research universities, but it is growing. Whereas the region once accounted for as little as 5% of the statewide expenditures in these fields, it now accounts for 10%. University-based R&D expenditures in the CNP region have increased 58% between 1993 and 1996, the highest rate of growth in the state. Nonetheless, this region continues to place third in R&D activity in this area.

### **CNP - Northwest (Erie)**

The BFTC/CNP's Northwest region enjoyed a robust increase of 50% in the number of IT firms between 1990 and 1997. The employment growth of 22% for that period earns this region a close third place behind Northeastern PA. The IT payroll increased by only 18%, the second lowest in the state.

These trends point to significant problems for the future of the IT cluster in this region. The IT cluster in this region suffers from its isolation from other IT firms as well as the lack of a strong University R&D presence.

### **CNP - South Central (Harrisburg)**

The South Central region of the BFTC/CNP's territory fared extremely well in developing its base of IT firms, the 70% increase in IT establishments in the region was the highest in the state. The employment increase of 8% ranked as the second worst performance in the state. The total wages in the cluster increased by a 21% between 1990-1997. The NSF did not report any R&D activity conducted by universities in this region.

### ***Northeastern Tier Region***

The number of IT firms grew by 53% in the Northeastern region. The region's employment growth of 23% ranked as the second highest performance in the state. The Northeastern region excelled in payroll growth for the IT cluster, IT firms in the region registered a 50% increase in 1997 over the 1990 payroll.

The region's universities accounted for just over 1.3% of the University-based R&D in the region in 1996. Math and Computer Sciences are not the specialty of the region's research universities, and expenditures were not reported for the years 1993 to 1995. The region accounted for less than 1% of statewide expenditures in these fields for 1996.

### ***Southeastern Region***

The Southeastern experienced the second-highest increase in establishments, 61%. Between 1990 and 1995, IT employment in the region actually decreased by a small percentage, but a rebound between 1995 and 1997 enabled the region to post a gain of 7%, the smallest in the state. IT Payroll in the region also increased by 24%.

The region has a base of university expertise that can support future growth in the IT cluster. IT related R&D expenditures in the universities accounted for just over 2% of the University-based R&D in the region. Math and Computer Sciences expenditures declined by 3% between 1993-1996, nonetheless the region has accounted for 11% to 13% of the statewide expenditures in these fields, the second highest in the state.

### ***Western Region***

The Western Pennsylvania region enjoyed the highest growth in IT employment (29%) and the second highest increase in payroll (40%). Western PA also posted a respectable increase of 51% in the number of IT establishments between 1990 and 1997.

This region simply dominates University-based R&D activity in IT-related fields. IT related R&D expenditures in the universities accounted for over 20% of the University-based R&D in the region. Math and Computer Sciences is the second-most dominant R&D specialty for the region's research universities. The region has consistently accounted for approximately 80% of the statewide expenditures in these fields. University-based R&D expenditures in the region have increased 5% between 1993 and 1996, the second highest rate of growth in the state.

## Appendix 1: Summary of Battelle Recommendations

Objectives	Strategies	Actions
# 1 Make Pennsylvania a leader in innovation and commercialization of technology	<b>Establish new partnerships, and strengthen existing partnerships with PA's universities and colleges</b>	<ul style="list-style-type: none"> <li>• Institutionalize an Ongoing University President's Forum</li> <li>• Establish an Innovation &amp; Commercialization Network in partnership with PA's universities and colleges</li> </ul>
	<b>Attract increased federal research and development funding</b>	<ul style="list-style-type: none"> <li>• <b>Work with the Commonwealth to create a Strategic Technology Investment Fund</b></li> </ul>
#2 Ensure Pennsylvania has the pre-seed, seed and related financial assistance to start and grow technology-intensive businesses	<b>Continue to invest, in partnership with the private sector, in new and expanding technology-based businesses.</b>	<ul style="list-style-type: none"> <li>• <b>Establish the Technology 21 Seed Capital program providing larger multi-year investments to selective firms</b></li> <li>• Expand and increase support of SBIR, STTR and ATP applicants</li> <li>• Establish a BFTC Reinvestment Pool</li> </ul>
#3 Make PA one of the leading states in the birth, nurturing, growth and survival of young, small technology firms by encouraging a thriving entrepreneurial culture.	<b>Improve PA's entrepreneurial culture and support for new and existing technology-based companies</b>	<ul style="list-style-type: none"> <li>• <b>Provide in-depth assistance to entrepreneurs and small technology-based companies</b></li> <li>• Establish an entrepreneurial education initiative</li> <li>• Assist communities to build entrepreneurial economies</li> </ul>
	<b>Support the growth of industry clusters in key technology sectors</b>	<ul style="list-style-type: none"> <li>• Support the development of industry competitiveness strategies for each of the industry clusters **</li> <li>• <b>Facilitate the formation of industry associations or communities of interest.</b></li> </ul>
#4 Ensure PA has the knowledge workers demanded by technology-intensive industries over the coming decade.	<b>Assist the commonwealth in ensuring that PA has knowledge workers demanded by technology-intensive industries over the coming decade</b>	<ul style="list-style-type: none"> <li>• Act as catalyst for creative approaches to education and training</li> <li>• <b>Undertake surveys of the education and training needs of key industry clusters</b></li> <li>• Support training consortia</li> </ul>
#5 Improve PA's image as a world class technology leader.	<b>Serve as a key advocate for technology-based companies, both large and small.</b>	<ul style="list-style-type: none"> <li>• <b>Conduct annual survey of CEOs of PA's technology companies</b></li> <li>• <b>Support creation of an industry led science and technology advocacy group at the state level</b></li> </ul>
	<b>Increase understanding in the marketplace, both inside and outside of PA, of the high tech capabilities of the state's workforce, support industries, education and training institutions</b>	<ul style="list-style-type: none"> <li>• <b>Undertake a statewide promotional campaign to increase knowledge and understanding of S&amp;T, the role it plays, and opportunities it provides.</b></li> </ul>

Source: Battelle Memorial Institute. September 1998. Positioning Pennsylvania's Ben Franklin Technology Centers for the 21<sup>st</sup> Century.

\*\* This report on the Information Technology Cluster represents that action item.

**Items in Bold-Face type correspond to items in Table 1: Opportunities for the IT Cluster.**

## Appendix 2: Notes on Data and Methods

### Industry Focus Groups

The CED facilitated industry-led focus groups for the cluster in each Ben Franklin region. These focus groups were followed up with targeted surveys, as well as electronic mail. The CED maintained a web site to encourage feedback from these participants at every stage of the process. More than thirty professionals participated in these sessions statewide. Each focus group session consisted of no more than ten persons and lasted approximately four hours to allow for in-depth discussion of the opportunities and constraints facing the cluster. The goal of these sessions was to identify *common* needs and to find a *consensus* for issues that would benefit from state action.

### Data Analysis

Sources for industry data included the Pennsylvania Department of Labor and Industry, County Business Patterns, Venture Economics, Securities Data Company, Woods and Poole (CEDDS), and the National Science Foundation. Data on employment, establishments and wages at the four digit SIC level for the cluster for 1990 to 1997 was provided by the Pennsylvania Department of Labor and Industry. This data is derived from the state's ES202 database and presents the most up to date information available on the state's industries, but it cannot be used for comparison to the nation and other states. The information in this section is excerpted from the *BLS Handbook of Methods*, produced by the US Department of Labor, Bureau of Labor Statistics.

### County Business Patterns

This report uses County Business Patterns data from the US Bureau of the Census from 1990-1995 to compare Pennsylvania to the nation and other states. The data is aggregated to Ben Franklin Partnership regions from county level data and to technology clusters from three digit Standard Industry Classification (SIC) Codes. For some SIC Codes where county level data was not disclosed, we used a weighting method to allocate the balance of the employment for that industry to a BFTC region. This allocation method is fairly accurate given the size of the BFTC regions. Establishment data generally does not suffer from this disclosure problem. Generally the figures presented are for employment only, because shares of employment, payroll and establishments are relatively consistent.

County Business Patterns counts establishments at the location at which operations are performed. It is not necessarily identical with a company or enterprise, which may consist of one or more establishments. Establishments are classified on the basis of its major activity and all data are included in that classification. In some cases, data is only provided at a broader industry level. For this reason, the sum of industry components may not equal the total shown.



CBP data is derived from universe files and are not subject to sampling errors. However, the data are subject to nonsampling errors, such as: inability to identify all cases in the universe; definition and classification difficulties; differences in interpretation of questions; errors in recording or coding the data obtained; and estimation of employers who reported too late to be included in the tabulations and for records with missing or misreported data.

### Department of Labor and Industry, ES202 database

The ES-202 program is a cooperative effort of the Pennsylvania Department of Labor and Industry and the Bureau of Labor Statistics (BLS) of the U.S. Department of Labor. The ES-202 program provides comprehensive coverage of employment and wage information for workers subject to State unemployment insurance (UI) laws and Federal workers covered by the Unemployment Compensation for Federal Employees (UCFE) program.

### Comparing ES202 to County Business Patterns Data

Covered employment and wages data from the ES-202 program differ from employment data published in County Business Patterns (CBP) of the Bureau of the Census in the following major areas:

- (1) CBP data exclude administrative and auxiliary units from "operating" unit data at the 4-digit level and include these data at the industry division level only. ES-202 covered employment, on the other hand, includes data for these units at the 4-digit SIC level.
- (2) CBP excludes agricultural production workers and household workers, some of whom are included in ES-202 covered employment data. CBP also excludes government units, all of which are included in the ES-202 program.
- (3) Every 5 years, data are collected for all multi-units within the scope of business and economic censuses and included in the CBP for that year. Annual updates for the larger multi-units are obtained from the sample selected for the Report of Organization Survey, and data for nonsample multi-units are estimated. Annual updates for single units come from the Internal Revenue Service and the Social Security Administration. ES-202 covered employment and wages data, on the other hand, include data collected from all active units each quarter.